EA-87-02

Ontario

ENVIRONMENTAL ASSESSMENT BOARD

VOLUME: 203

DATE: Wednesday, May 16, 1990

BEFORE:

A. KOVEN, Chairman

E. MARTEL, Member

FOR HEARING UPDATES CALL (TOLL-FREE): 1-800-387-8810

FARR & ASSOCIATES REPORTING INC.

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EA-87-02

HEARING ON THE PROPOSAL BY THE MINISTRY OF NATURAL RESOURCES FOR A CLASS ENVIRONMENTAL ASSESSMENT FOR TIMBER MANAGEMENT ON CROWN LANDS IN ONTARIO

IN THE MATTER of the Environmental Assessment Act, R.S.O. 1980, c.140;

- and -

IN THE MATTER of the Class Environmental Assessment for Timber Management on Crown Lands in Ontario;

- and -

IN THE MATTER OF a Notice by the Honourable Jim Bradley, Minister of the Environment, requiring the Environmental Assessment Board to hold a hearing with respect to a Class Environmental Assessment (No. NR-AA-30) of an undertaking by the Ministry of Natural Resources for the activity of timber management on Crown Lands in Ontario.

Hearing held at the Offices of the Ontario Highway Transport Commission, Britannica Building, 151 Bloor Street West, 10th Floor, Toronto, Ontario, on Wednesday, May 16th, 1990, commencing at 8:30 a.m.

VOLUME 203

BEFORE:

MRS. ANNE KOVEN	Chairman
MR. ELIE MARTEL	Member

Farr & Associates Reporting, Inc.

A P P E A R A N C E S

MR. V. FREIDIN, Q.C.) MS. C. BLASTORAH) MS. K. MURPHY) MS. Y. HERSCHER)	MINISTRY OF NATURAL RESOURCES
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MR. R. TUER, Q.C.) MR. R. COSMAN) MS. E. CRONK) MR. P.R. CASSIDY)	ONTARIO FOREST INDUSTRIES ASSOCIATION and ONTARIO LUMBER MANUFACTURERS' ASSOCIATION
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APPEARANCES: (Cont'd)

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MR. J.W. ERICKSON, Q.C.) MR. B. BABCOCK)	RED LAKE-EAR FALLS JOINT MUNICIPAL COMMITTEE
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MR. J.W. HARBELL) MR. S.M. MAKUCH)	GREAT LAKES FOREST
MR. J. EBBS	ONTARIO PROFESSIONAL FORESTERS ASSOCIATION
MR. D. KING	VENTURE TOURISM ASSOCIATION OF ONTARIO
MR. D. COLBORNE) MS. S.V. BAIR-MUIRHEAD)	GRAND COUNCIL TREATY #3
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MR. H. GRAHAM	CANADIAN INSTITUTE OF FORESTRY (CENTRAL ONTARIO SECTION)
MR. G.J. KINLIN	DEPARTMENT OF JUSTICE
MR. S.J. STEPINAC	MINISTRY OF NORTHERN DEVELOPMENT & MINES
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MR. P. ODORIZZI	BEARDMORE-LAKE NIPIGON WATCHDOG SOCIETY

APPEARANCES: (Cont'd)

MR. R.L. AXFORD	CANADIAN ASSOCIATION OF SINGLE INDUSTRY TOWNS
MR. M.O. EDWARDS	FORT FRANCES CHAMBER OF COMMERCE
MR. P.D. McCUTCHEON	GEORGE NIXON
MR. C. BRUNETTA	NORTHWESTERN ONTARIO TOURISM ASSOCIATION

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I N D E X   O F   E X H I B I T S

---Upon commencing at 8:55 a.m.:

MADAM CHAIR: Good morning. Please be seated.

Ms. Cronk.

MS. CRONK: Good morning, Madam Chair, Mr. Martel.

As you will see we have witnesses in a number of locations this morning around the room both --

MR. MARTEL: The foolball team gets bigger.

MS. CRONK: That's right.

If I could start, however, by introducing to the Board the two new members of Panel 7 who were unable to be before the Board previously when Panel 7 commenced its evidence.

The first is Mr. Bill Smith, to Mr. Martel's left. Mr. Smith's resume appears at page 39 of Exhibit 1131 and the Board will remember that Exhibit 1131 is the Panel 7 OFIA/OLMA statement of evidence on tending.

And in brief, for the assistance of the Board, Mr. Smith holds a diploma in forest technology conferred by Lakehead University in Thunder Bay in 1977. He also holds, as you will recall, do a number

of other members of this panel, a number of certificates and licenses relating to the use in timber management of herbicides. He is currently employed by Abitibi-Price Inc. Lakehead Woodlands Division in Thunder Bay as freehold land supervisor, a position he has held since 1980.

In that position he is responsible for, among other matters, the field coordination of the division's herbicide application programs and, as well, for assisting in vegetation management technology issues within the division.

Prior to 1980, he was employed by the Ministry of Natural Resources in a number of capacities, a number of positions as resource technician and unit technician on two different management units, the Black Sturgeon and Graham management units out of Thunder Bay.

His evidence before you, Mr. Martel, Madam Chair, will concern the tending activities described in case study 4C which you will recall is the case study of Abitibi-Price Inc. Lakehead Woodlands Division. He is proferred as an expert before you in tending activities in the area of this cover type in the area of the undertaking.

The second witness who is before you this

morning who was not present when Panel 7 commenced its evidence is Dr. Maxwell McCormack Jr., the far left of Mr. Martel. His curriculum vitae appears commencing at page 8 of the Panel 7 statement of evidence.

Very briefly for the assistance of the Board, as that curriculum vitae indicates, Dr. McCormack holds a doctorate in silvics from Duke University, North Carolina conferred in 1963 and a Master's in silviculture from the same university conferred in 1959.

He obtained his forestry degree from the University of Maine, Orono In 1956.

In our submission, as appears from Dr. McCormack's resume and as will, in our submission, emerge from the oral evidence which you will hear, he is a widely recognized expert in North America on the use of herbicides in timber management activities. His professional forestry experience extends over some 37 years.

He has been involved in a wide variety of academic teaching endeavors at a number of universities in North America and direct field experience with the use of herbicides. You will see, for example, that he has taught variously at Duke University in North Carolina, Southern Illinois University in Illinois, the

University of Vermont in Burlington, Vermont, just to mention a few.

Since 1976 to the present Dr. McCormack has been engaged as research professor of forest resources in the cooperative forestry research unit of the College of Forest Resources, University of Maine, Orono, Maine. I am going to invite him in a moment to elaborate on that position for the Board.

You will see from his curriculum vitae that he holds a number of awards and honours in forestry and has published extensively. In particular, Madam Chair and Mr. Martel, you will see that he has been actively involved in herbicides in forestry research, has published extensively for the last 30 years on the use of herbicides in forestry and the role of herbicides in silvicuture and vegetation management.

The areas on which he will give evidence to the Board were outlined by me during the commencement of this panel's evidence in Thunder Bay some two weeks ago, but briefly again in an effort to be of assistance to the Board there are six main areas.

First, on the need for tending in timber management generally and specifically in the area of the undertaking; secondly, on the choice among tending alternatives; third, on the need for flexibility and

management alternatives in respect of tending activities; fourth, the need for the use of herbicides in tending activities and the appropriateness of their use; fifth, the need for research and development as the Industry sees it for registration of additional herbicides. That evidence will also be given or evidence on that issue will also be given by Mr. Tomchick. And the sixth issue to be addressed by Dr. McCormack are the benefits of the use of herbicides in timber management.

On the basis of that brief outline I would ask that he be accepted by the Board as an expert qualified to give opinion evidence regarding the use of herbicides in timber management and I would ask that both Mr. Smith and Dr. McCormack be sworn at this time, Madam Chair.

MADAM CHAIR: Yes. Could you please come forward, gentlemen.

MAXWELL McCORMACK,
WILLIAM SMITH, Sworn
RODERICK CARROW,
ROBERT TOMCHICK,
MURRAY FERGUSON,
PHILIP BUNCE,
GEORGE STANCLIK, Recalled

MS. CRONK: Thank you.

DIRECT EXAMINATION BY MS. CRONK:

Q. Dr. McCormack, if I could turn

initially to you, sir.

With the Board's permission there is no need for the witness to stand unless you prefer to. That's acceptable, Madam Chair?

MADAM CHAIR: Yes.

MS. CRONK: Q. Dr. McCormack, could we begin in this way?

Could I ask you to explain to the Board, if you would, please, in brief what the cooperative forestry research unit of the College of Forest Resources at the University of Maine Orono is? What is that organization?

DR. McCORMACK: A. The cooperate forestry research forest unit is a group of professional people funded by forest industry, a voluntary contribution from private industry based on their areas of forest land under management. It is housed at the University of Maine and we maintain faculty status and we are members of the graduate faculty officially.

We conduct research in support of forest industry in an effort to help them improve forestry practices, improve the quality of the timber they produce and we function in that mission through guidance of an advisory committee of industry

representatives, and in so doing we interact with their operational procedures.

Much of our research is superimposed. Of course there are operational activities and those same activities are carried out through private industry across Maine and actually because of some common ownership across the Maritime provinces as well.

My responsibility in the research unit is for the silviculture research program that encompasses a variety of silvicultural activities, one of which is development of herbicide technology in support of timber production by our industrial cooperators.

Q. Are you familiar, Dr. McCormack, with the forest conditions in the area of the undertaking generally?

A. Yes, I am.

Q. And how is that, sir? What involvement have you had over the years in forestry-related matters particular to the area of the undertaking?

A. It's covered a variety of activities where there has been interaction with personnel from the area of the undertaking where private, as well as public professionals have attended and participated in training programs which I have conducted or which I

have participated principally on the use of herbicide technology in timber production.

In addition to that, I have participated in a variety of meetings and seminars and training programs in Ontario and very specifically some years back I was employed as a consultant by Ontario Ministry of Natural Resources to evaluate the herbicide program that existed at that time in the northcentral district and I conducted a three-week investigation of herbicide use in the northcentral district working out of Thunder Bay at that time.

Q. I understand, Dr. McCormack, that you also have certain teaching commitments in Canada with respect to herbicides and their use in timber management activities?

A. Yes, I have been involved for the provinces of Ontario, New Brunswick, Nova Scotia, Prince Edward Island, Newfoundland conducting formal training programs, anywhere from two to three days up to six days, addressing the use of herbicide technology in timber production.

This has also involved contracts with what is now Forestry Canada, to conduct a series of training programs in the Maritimes. I initiated and have taught on a regular basis a five- to six-day

formal course in the continuing education program at the Maritime Forest Ranger School in Fredericton which has been taught at least annually.

As you may recall, it was necessary to cancel it this spring because of my illness and in order to maintain the schedule of the Board.

Q. In teaching that particular continuing education course, Dr. McCormack, does it include any instruction regarding the use of herbicide?

A. It is devoted to the basis for the use of herbicides and goes into considerable detail on the technology of prescription development and delivering those prescriptions in an operational framework in timber production, and there have been a variety of people attending these courses from across eastern Canada.

Q. Thank you, Dr. McCormack. I am going to ask you to turn now, if you would, please, to the subject matter of the evidence that you will be giving before the Board.

MS. CRONK: For that purpose, Madam Chair, the Board might find it useful to have at hand a copy of Exhibit 1132 which includes photocopies of the overheads to be referred to by Dr. McCormack.

You will recall that as part of that

exhibit a number of materials were filed. One of the packages included the photocopies of overheads to be referred to by Dr. McCormack.

Q. Dr. McCormack, could I ask you first, if you would, please, to outline for the Board what issues -- to what issues generally your evidence is directed?

A. What I have tried to do is take the package of evidence as it exists in the evidence statement and try to extract highlights and points for emphasis and some other points for some moderate elaboration in an effort to clarify the information that is contained therein.

I will try as I go along to make reference to specific pages in the statement of evidence and will pretty much proceed in the order of the material in the first part of the statement of evidence.

As I try to pick out the points for emphasis, I would like to provide a little background on the vegetation dynamics of forest vegetation because in fact what this is all about is managing that vegetation and the dynamic process which takes place.

I will emphasize the need for tending as we manage this vegetation which in the production of

the timber crop is vegetation which competes with the growth of that crop.

I would like to discuss the reliability of herbicide technology since this is a silvicultural tool which has existed for some time. As earlier witnesses have pointed out to the Board, some of the first aerial applications of herbicides for forest production occurred in the late 1940s in Ontario, as well as further east. The first applications occurred in 1947. This technology has been developing ever since, though the recognition for the need for this tending goes way back through the years.

I will address some aspects of the prescription and the nature of how these herbicide prescriptions should be and can be site specific, and then we will spend some time to illustrate the efficacy of these treatments and show that this herbicide technology really does work.

So starting with what is Section 1, beginning on page 59 in the statement of evidence, recognizing that this information has been summarized for the Board, but to address that first section I point out that - in the prepatory statements there expressing the feeling of the Industry - tending and protection are essential and necessary parts of a sound

timber management program.

And with that I would like to point out why things are happening the way they are in the forest and that the dynamics are real. This is defined by nature and we as managers of the resource must learn to anticipate and deal with these dynamics and the characteristics of the species involved which are predictable and known within certain limits.

There is a section of the statement of evidence running from page 63 and on to page 64 that, if I may, I would like to refer to a diagram which is included in the exhibit with the transparencies. That is a diagram I developed some years ago and has since been adapted and adopted in a number of programs to help to describe the vegetation dynamics which take place.

Most of the species represented here are represented within the area of the undertaking, though this is somewhat of a generic diagram. It's done somewhat like a fishing chart, if you will, since that seems to have worked out as a fairly good way to illustrate these things.

With regard to the species, which is the list coming down the left side, they are characterized by six of what are considered to be important

characteristics that determine the ability of each species to occupy a site following disturbance and how aggressive is occupies that site.

And as you look across the top it's the things that determine the existence of those species: How often does a seed crop occur recognizing that that's one source of regeneration; how far does that seed go, is it wind blown, is it a heavy seed that falls in place because that determines to a great extent the potential of that species to move into a harvested area, an area which has been subjected to wild fire or such disturbance; do the seeds store in the forest floor. Some plants have a buried seed strategy that enables them to spring forth after long periods of time where they have not even been noticed or observed on a site.

Does the species sprout, how rapid is its initial growth rate, and the part that's often overlooked is root system extension or occupation of site; what is the capability of a species to extend its root system and take over a site and thereby control it, which is a major mechanism of competing with what might otherwise be desirable timber species.

So each of these species are characterized across those six characteristics.

In terms of the importance of that respective characteristic to a species, this is reflected in the size of the circle and then the more the circle is filled in the more aggressive and effective is that characteristic.

So in summary, when one sees, for example, here for aspen a series of large circles which are filled in, that says that there is a species that has a tremendous capability of moving in rapidly and occupying a site. And as is recognized, for example, aspen is a prolific sprouter, thus a large circle filled in under sprouting. Its initial growth rates are very rapid and its root system is very aggressive in extending and occupying a site. So that you can characterize the species according to the way the circles exist and are filled in.

Another example might be, for example, under Seed Storage. Two very significant characteristics that we recognize and practice is that the seed of pin cherry and/or raspberry falls down into the duff of the forest floor and remains viable in that position. It is not documented especially for raspberry, periods of time that exceed a hundred years.

So the message here is that in harvesting a site you may see absolutely no evidence whatsoever of

the presence of raspberry which is a serious competitor, yet when a wild fire or harvesting activity takes place the potential for that species to occupy the site in a hurry is there because of the buried seed.

So you can see that -- sometimes the way I represent this is these are the horses that are going to enter the race and we are going up to the betting window and we want to try and pick a winner.

The problem is the horse from our stable is spruce. Some of the horses in the other stable are aspen and red maple and pin cherry and the odds aren't real good, so we have to do what we can to modify conditions in order to improve the opportunities or the odds for the horse from our stable, and that's what this vegetation management is all about.

And in this statement of evidence it is briefly described that our desirable timber crop species are at a disadvantages because of these types of characteristics that are described in more detail in this diagram.

This explains in a nutshell why we have to manage this dynamic.

MS. CRONK: Dr. McCormack, just before you move on from that, first, for the benefit of the

Board, a photocopy of that is the third photocopy in Dr. McCormack's overheads that have been -- in the package of overheads that have been provided to the Board.

Q. Secondly, Dr. McCormack, when you referred to the term vegetation management what do you mean by that phrase?

A. By vegetation management I refer to management activities which can be carried out by the timber manager in order to modify the conditions of that vegetation in an effort to put the crop species in a more advantageous position.

Q. And how can we relate, if at all, the types of characteristics you have just described of the various potential competing species to the development of conifers?

A. It's characterized here. These competing species have a capability to occupy a site and grow more rapidly than the crop species of spruce, jack pine.

So that in the initial stages of establishment and development they are at a disadvantage and this is a very critical period of time in establishing a crop, thus we must manage these other species in order to suppress their capabilities to

provide a better chance for the crop species.

Q. Thank you.

A. Moving on to a diagram which also is not specifically included in the evidence statement that I borrowed from my colleague Dr. Newton at Oregon State --

Q. I'm sorry, Dr. McCormack. Just to assist the Board it is, however, photocopy No. 4, overhead No. 4 of the package you have.

A. This is a graphic portrayal over time. As you can see from left to right are the years since, as illustrate here, site preparation. In some cases that would be typical following a harvesting operation, that the brush is removed in year one, brush being the woody and other competing vegetation, that we can see two different sequences of events: One with vegetation management and one with without.

So that even though the shrubs are maintained on the site, their relative proportions are reduced to allow the conifers - in this case conifers being the crop trees - to develop and become some of the dominant vegetation and, in effect, manageable by the timber manager and this portrays the two relative extremes of with and without vegetation management.

Q. Is that, Dr. McCormack, with and

without vegetation management of all types or of any particular type?

A. Well, it would be a tending practice that would be appropriate to the situation, and as we go on I will outline the various options that are available to a manager to accomplish what is portrayed here.

Q. And you indicated that you -- I think you said that you borrowed this diagram from your colleague Mike Newton. Who is Mr. Newton, Dr. Newton?

A. He is a professor of forest ecology at Oregon State and is certainly one of the senior members of a group of us who have worked on vegetation management now for many years.

Q. Thank you.

A. So why is all this vegetation of concern? Well, with us moving on now to what is my fifth transparency, and this also is a relatively generic diagram, where this tree here in the centre that I am now highlighting with the blue is, for purposes of discussion, a crop tree.

And as we look at the situation here, generally we break our competing vegetation down into three groups because sometimes they are considered differently when tending must take place, that we have

woody broad leafed brushy species or undesirable species, aspen or soft maple being an example, we have broad leafed herbaceous vegetation which can occupy a site and then there's grassy vegetation and they sometimes must be managed in different ways, but they all are potential competitors and they compete for the types of things that are illustrated in this diagram, many of which are fairly obvious, sunlight, moisture, space, but also below ground.

The part we don't see is that part which is most often overlooked, they're competing for moisture which is available in the soil, they're competing for space, they're competing for nutrients and sometimes this can be a very aggressive competition.

And during periods of time where any one of those necessities for the development of the vegetation borders on being limiting, for example, a prolonged dry period during a growing season where trees have just been planted, it becomes especially critical that moisture is available for these new planted trees and if there is competing vegetation present that could be a significant factor in reducing survival, reducing establishment of newly planted trees for young vegetation throughout this competition.

There are other things which take place which are noted here; air movement, for example. On sloping ground we showed in a study many years ago that the presence of low weed cover would actually capture cold area, restrict the flow of cold air during periods of spring frost and where the weeds were not controlled. there was a higher level of frost injury to newly planted trees as compared to where the weeds had been suppressed.

So there are other subtle things which take place here indirectly related to the competing vegetation that interfere with the establishment of planted trees in many cases.

There are also other examples where vegetation is an alternate host to a pathogen or in some cases habitat to small rodents which girdle planted trees, this type of thing. So there is a whole complex of interactions which take place that are at least in part directly related to this competing vegetation.

On the diagram, this is a diagram that's been used in many cases, but these little red lightening bolts perhaps should get a brief explanation. In part, they represent what is still a bit unknown within the science of forest weeds, but one

area that is highly suspect at this time is an area referred to as allelopathy where some plants can introduce chemical substances into the environment which interfere with the growth and development of other plants. It's somewhat of a natural mechanism by which that plant species assures that it's going to be present and able to establish itself within that environment.

This is an area that is currently under study in terms of possibilities for this interaction. Within the area of the undertaking there are strong suspicions, but there is very little that has been actually documented, but we know these things are taking place. One, for example, that we have studied briefly would be raspberry, common red raspberry which is also very common across the area of the undertaking.

When its leaves are allowed to disintegrate within the forest floor, we find that the substances which remain in the forest floor appear to reduce germination and early growth of spruce seedlings; thus, beyond the competition for moisture, space, sunlight and nutrients is the possibility of other substances being introduced here that might interfere with the development of desirable vegetation. That's what the lightening bolts are all about.

Q. Just before you leave that overhead, Dr. McCormack, on the far right-hand side of the overhead the letters ALT host appear. To what do they refer?

A. The ALT stands for alternate, as an alternate host to a pathogen where a disease that can effect a desirable forest tree species must in its life cycle go through another species. One of the outstanding examples in the forestry -- within forest science is the blister rust of white pine. White pine blister rust, which can be a serious problem in producing white pine crops to complete its life cycle, must go through plants of the genus ribes which are goose berries and currants.

For that life cycle to complete it must go through gooseberries or currants before it can go back to pine; thus, if somebody wanted to produce, for example, a high quality white pine crop, vegetation management which reduces or eliminate the gooseberries and currants would benefit that crop by breaking the life cycle of a disease that could be very detrimental to the crop trees.

So this is another aspect of vegetation management that is sound in terms of the total package of considering all pests which can interfere with the

production of a crop.

Q. Thank you.

A. So if we take these considerations and, if I may, with the sixth transparency refer to a basic equation which is kind of the lingo of weed scientists of the day because we are recognizing that it is more than competition.

I have described for you now a possible role of allelopathy, I've described in some detail the competition which take place. There is was one other aspect that can be important that is occurring out in an actual forest regeneration situation and that's referred to here as mechanics, and by this is the mechanical injury. For example, a jack pine tree growing with a sprouting aspen next to it, the aspen sprout can move and whip back and forth and thereby remove foliage and buds from the desirable jack pine tree and this is a form of mechanical interference.

So now we better appreciate that we have a package here all of which, as we developed a science, we refer to as interference and I introduce this mainly to make the point that beyond what I have already described this mechanical disturbance of crop trees can be important. Especially when buds and branches are removed or deformed it directly interferes with the

ability of those crop trees to assume a normal growth pattern.

To further illustrate the dynamics with which we are dealing in the forest ecosystem, I move on to what is transparency No. 7, a diagram which I have developed to illustrate this relationship. It represents changes over time which can best be looked at across the bottom, time since harvest or mechanical site preparation or disturbance of a site expressed in years, and please understand that this is a relative illustration of these relationships.

On the vertical axis, increasing as one goes up that axis, the increasing amount of biomass or plant growth of the vegetation over which we are concerned, the competing vegetation, the undesirable vegetation which can interfere with our crop trees, it typically increases as it grows and it grows over time.

A couple of things that are illustrated here. This development of the competing vegetation occurs at different rates and one of the major factors that effects the rate of the development of this vegetation which requires management and tending is site quality, and I think site quality has been discussed at some length before the Board, but in effect what you have are -- is an infinite number of

these S-shaped curves across time representing different levels of site quality.

I selected three for the purposes of discussion. The first curve being one of high site quality, the middle one of medium site quality and one of lower site quality showing that if we, for example, look at preferably treating this vegetation in a tending treatment somewhere from about 25 per cent of its development up to 75 per cent of the development, which we recognize as the timely way to conduct tending, that one can see that that level of development occurs at different times relative to site quality.

So it shows that there is this variety, it shows -- at this point it begins to introduce the timing of the tending treatment as considered by the manager, that the higher the site quality the more critical is the choice of time of entry because if you look on the high side quality, the time period where it is in that period of development that is considered desirable for treatment, you have about a two-year span.

And in contrast to a lower site quality, you see that you begin to get across the full development of this vegetation following harvest or

site preparation a wider window. If may be three, four, five years but a manager has a little more latitude in making that entry, but it also shows that it's especially critical on good sites.

And if you note on that high side quality curve I have also put plantations because of that same relationship, though assuming that most plantations are going to be on some of the better sites, that the timing window is narrow there because it's especially important in getting newly planted trees established.

So with this I have tried to illustrate the dynamics of the vegetation, the dynamics of how the different species develop, but at this stage introduce an operational consideration of how all these factors inter-relate with site quality within the conduct of timber management.

Q. Dr. McCormack, when you refer to a "better site" or a site having high quality, what do you mean by your use of that term?

A. The higher the site quality indicates a better capacity of that site to produce timber growth. The better the site, the more productive the site, the more likely the higher volumes of usable timber in less time can be attained on such sites, and then as that site quality drops off it takes a little

longer to achieve that or you may reach a point that you are unable to produce as much volume and it's the better quality sites that we are best able to satisfy our timber need.

Q. Apart from a correlation with respect to timber volume, is there in your view any correlation between the higher site, the higher quality sites and degree of competition?

A. That's in effect what I have tried to illustrate here. It is a well-established fact within the forest ecosystem that the better the site the more aggressive and severe is the competing vegetation, and as I tried to illustrate here the more critical is the timing in carrying out tending to manage that competing vegetation.

So, in effect, as site quality gets better there is no more pressure on the manager to do something and to do it right in the most timely manner.

Q. Thank you. Dr. McCormack, then turning next to the entire issue of available tending alternatives, could you outline for the Board, please, what the Industry's position is regarding the choice among tending alternatives?

A. This moves us on to Section 2 of the statement of evidence which begins on page 69 and just

to bring this into perspective, the introductory statements of Industry in Section 2.2 points out the ways for the choice among tending alternatives to be used within a management unit and the term evolutionary is used here to describe a process because it takes into consideration a variety of components, and as those components are evaluated and tending practices develop a base for carrying out the tending procedures actually evolves.

And as outlined there on page 69, it points out that it takes into consideration the silvical characteristics of the species present in the unit. In terms of what is meant there, I would refer you back to my fishing chart that describes the silvicultural characteristics as an example, it also considers terrain, site, stand conditions and we've touched on that.

The proximity to non-timber resource values have to be -- this has to be considered as well because it is a factor in determining how the tending alternatives are selected or how a tending decision is made. Wood supply, of course, is the basis for what we are discussing throughout and the available resource. You can only do what you can afford to do and it's not very realistic to plan to do something that is beyond

the limits of support.

So with that, going further on the information summarized on page 69, is listed the tending alternatives which are available to a timber manager. And just in listing, and I will elaborate on those as we go on, considering the basic choices, one is mechanical where a manager would go in with equipment and do as the term suggests, do it with mechanical type equipment directly on the site.

A second choice would be prescribed fire or prescribed burn where fire is employed intentionally as a tool to accomplish some of the needs of a tending operation.

A third choice is a manual alternative where the activities are carried out by people on site manually, working with tools which can be operated manually by individuals on the site.

A fourth alternative is the chemical approach meaning herbicides, then in looking at all of these combinations where various combinations of these four possibilities can be employed and then, as outlined in the statement of the evidence, a management decision might be that no treatment is required and that has to be considered as an alternative.

I've put a boxes around no treatment

required because even though that may be a wait, watch, see what happens, consider going in later decision, it seemed inappropriate to elaborate on that one. I have put a box around chemical because a major concern within our statement of evidence and before the Board is the use of herbicides and that's the one that I will elaborate on the most.

Q. If I could stop you there just for a moment, Dr. McCormack, and turn to the Industry representatives on the panel for a moment.

Mr. Ferguson, perhaps if I can direct my question to you. Are all the tending alternatives outlined by Dr. McCormack on that overhead or some or part of them the alternatives in practice actively used by timber managers for tending in the area of the undertaking?

MR. FERGUSON: A. Yes, I believe that to be the case. They are used in different intensities, but I believe they are all considered and used in the area of the undertaking.

Q. Thank you.

Dr. McCormack, could you turn then, if you would, please, to each of these and recognizing that the Board over the last numerous months has heard evidence from Ministry of Natural Resources' witnesses

concerning their perspective of the use of these various tending measures, could you outline for the Board with respect to each, please, what the Industry's perspective is on their appropriateness and their advantages and disadvantages?

DR. McCORMACK: A. Yes, I will work my way down through that list and I recognize that many considerations that relate to these alternatives have been presented to the Board, but I go back to some of when I was introduced that point out that my perspective comes from Industry, my current professional involvement relates to the operational scene within Industry operations, so I represent this as that perspective.

There is summary text material on the mechanical methods and the various attributes ranging from page 70 through 73 of the statement of evidence and I will highlight a few of those at this time.

Looking at mechanical methods. These involve usually taking some type of machinery onto the site where direct interaction between the machinery and the site takes place. So right off one can see there are some limitations, that if there are already crop trees in place it's a difficult to thing to carry out.

But as we look at this, some of the major

things that I believe should be considered is the level of soil disturbance. Once we take machinery on a site we have to accept a certain level of soil disturbance. Now, that's fine if it's desirable, but if it is not desirable it becomes a problem, and ecologically professional opinions follow the line that that which is most ecologically sound is that which minimizes or eliminates the undesirable disturbance. So this is a very important consideration when considering mechanical methods.

I think it's fairly obvious that when machinery gets on a site it's not very selective. Chains or drums or crushers or whatever it happens to be will not distinguish between species, that you must accept that it will do what it has to do without regard. Consequently, this type of a treatment usually occurs during site preparation prior to placing the crop trees on the site or prior to regenerating the site.

This disturbance does something else in that it simulates some of the competing vegetation. I made reference earlier to viable seed stored in a duff, the raspberry, pin cherry type seed. Disturbance with mechanical methods can actually stimulate this vegetation and aggravate the problem further and at the

same time aggravate the competing vegetation which is in place.

Damaged, injured vegetation is more difficult to manage in the period of time following that damage and it can react by producing more sprouts and, in some cases, more prolific growth of the type which competes with the desirable crop trees.

So these are all complications that have to be considered before a mechanical method is applied on a site.

On the other hand, recognizing that this is most often used as a site preparation method, there are distinct advantages gained through a mechanical approach and one which I know has been pointed out before the Board is the redistribution of residues which occur on a site.

It is often this redistribution of residues that facilitates or actually makes it possible for a tree planting crew to go onto a site and do what it has to do in terms of planting the trees, and this is often a necessary step to carrying out that process and that, I point out, is planter accesss as well, but the residues have to be moved in order to get the trees in place and on sites where there are excessive organic layers. This is organic material, fairly thick layers

over the mineral soil.

As I think has probably been pointed out adequately by now, the root systems of trees must be placed, at least in part, in the mineral soil for them to survive and grow and occupy a site.

So in terms of moving the residues, gaining planter access and putting the organic layers into a condition to facilitate planting, these are advantages which can be achieved using a mechanical method. So in this case there are disadvantages and there are advantages and they must be weighed by the managers in order to make their decision whether or not to apply such an approach.

Q. Could you turn then, Dr. McCormack, to the next and that is what you have described as fire or burn. And recognizing, as I have said, that the Board has heard evidence about this technique, site preparation, in the Ministry of Natural Resources' perspective, just looking at it as a potential tending measure, what does the Industry perceive to be the advantages and disadvantage of this technique?

A. Obviously here, too, we have some limitations because of the nature of fire. This is briefly described in the statement of evidence from page 73 to 75. So where prescribed burning is used -

to look at some of the attributes duties there that are behind decision-making that might relate to the use of prescribed burning - you have to have appropriate and sufficient fuel to carry the fire. So that's a prerequisite and if that is not there, then this is not an alternative that can be considered.

Very specific conditions exist in order to carry out an effective burn. These conditions are often not very predictable by the manager. It's like weather forecasting and this sort of thing and we can't watch the evening news on TV and say: Well, we will go out tomorrow and burn. And even if you could, it's difficult to plan the operation where personnel and equipment are involved in order to carry it out.

So it's difficult to plan because of the need for specific conditions and you can never be assured when those conditions will occur or if they, in fact, will occur during the time that you want to carry out the burn.

If you are able to carry out a burn, properly carried out, escape should not be a risk, but nevertheless whenever a fire occurs in a forest site there is the risk of escape and that's a risk that has to be contended with in carrying out the prescribed burn. This is obviously an undesirable consequence.

With recent developments through society relative to air quality, many questions are now being raised where large prescribed burns have been carried out and the role of the smoke. Is this a problem and, if so, then it is a problem that goes hand and hand with carrying out prescribed burning.

The burning can be carried out at relatively low cost, this of course is a strong advantage; burning can reduce surface layers, that can be a gain; on the other hand, a hot fire can result in some nutrient losses, that would be undesirable. It can reduce the amount of vegetation which is present, it can reduce the slash and thereby facilitate the operations of tree planting crews, but in reducing the vegetation and removing the slash and letting more sunlight reach the forest floor, there is a risk of stimulating some of the fire species.

Those species - and this is the case - we would address principally the undesirable species which within the normal course of ecological succession have a strategy which follows fire. A pin cherry, raspberry again are good examples.

And then lastly, of course, fire is not selective. The fire burns, it burns where it will and it doesn't really matter and fuel is susceptible to the

burning. So, again, we have an alternative which has some advantages, it can be a useful tool to managers, but we must recognize that there are some risks and disadvantages as well.

Q. What about manual tending measures, Dr. McCormack?

A. Manual tending measures deserve some careful consideration because this is an alternative that has been used, to a greater extent, in recent years than the ones I have discussed thus far. Manual methods also have various advantages and disadvantages and must be viewed within the context of this dynamic forest system.

Of the alternatives out there, depending on how manual methods are carried out, is worker safety/risks. These methods are labour intensive and with that are the concerns which go with -- regarding safety and where power equipment such as chain saws or brush saws, clearing saws, spacing saws, however one refers to them, are used they must be carefully carried out or worker safety is a definite problem that the manager must consider.

In order to carry out manual methods direct access is required. You have to be able to deliver the workers in a safe, comfortable manner to

the site and get them back at the end of the workday. This means roads, culverts, bridges must be maintained, vehicles must be maintained, and you must be able to get these workers close enough to the area that they can carry out the tending effort.

I think of great significance here to timber managers, because it is important to view this tending within the framework of the operational areas which must be treated, is what is referred to here as the time/area productivity ratios. How much of an operational area can be treated within the time window that is available to carry out the treatment, and one must look at this in terms of the worker productivity and how much operational area can be treated or another way, how many workers it would take to adequately treat the operational area and productivity here is relatively low.

When you envisage what it takes for a worker to cut through brush and remove it and look in terms of: Is this half a hectare, is it a hectare, and that of course is directory related to the amount of material that is there, and if you consider things like raspberries or aspen sprouts or grassy weeds, it's a formidable task to have any reasonable level of productivity.

In process of pursuing this, there are risks to the crop trees. Spacing saws, chain saws and so forth are also not selected unless very, very carefully administered by the workers and most studies that have evaluated the manual methods have shown that crop trees are lost or injured in the process of carrying out the manual methods.

I am tempted to offer an aside, that in many years of working with the various alternatives and in studying vegetation management of my own work, as I look back through my records I have lost more trees and eliminated more trees in pursuing manual and mechanical methods that I ever have with herbicide tests. A mower blade or a saw blade is pretty hard on crop trees.

There are terrain limitations. This relates to access, but if there is any difficult terrain or obstacles across that terrain it makes it very difficult for worker access and safety to be maintained, and I have already mentioned the judgment selectivity that must be carried out by the workers.

Of special importance is a consideration of what I refer to as a transient release. Manual methods are temporary and temporary only when they exist alone. It is the rare, rare case that manual methods are used that at least a second entry is not

- required because manual methods only remove the top part of the competing vegetation, they do nothing to reduce the live presence of the competing vegetation.

The root systems stay viable, they often resprout so that where there might have been two or three sprouts at the time of the first manual treatment you may end up with 10 to 15 sprouts off the same root system growing at a more rapid rate and it requires re-enty and not only re-entry, but conditions that are more difficult with which to contend than during the first entry.

So it's easy to set that aside and I referred to that in my competition diagram. We don't see the roots, so we take the brush off the top and forget that the roots are down there and still alive and growing and this will vary with the time of year that the treatments are carried out.

And I would also point out that this is a relatively drastic change in the ecosystem. A group of sprouts are severed and dropped down on the ground, they all drop down at once and if they drop down physically across a crop tree there can be direct injury to the crop tree. There is sudden sunlight which comes in which is often more than crop trees can adjust to in the first year or two, so they are

actually set back slightly in carrying out their growth processes. So there are other complications and a drastic change taking place.

The costs are relatively high. Costs are outlined in our statement of evidence and later we are prepared to elaborate on the relative costs of these various alternatives.

These treatments are and can be very site and stem specific. So as long as the other needs can be satisfied relative to access, safety, well trained workers, there is a possibility here of carrying out very specific by site and stem treatments which may, in some cases, be the best choice for the timber manager. So there is a characteristic here which could be advantageous.

Q. Turning then to herbicides, Dr. McCormack, generally -- perhaps I should ask you this first. Generally, how are herbicides used by the Industry in timber management including in the area of the undertaking, as you understand it?

A. Well, herbicides can be used in a variety of ways. These are summarized very briefly in what is overhead No. 13. We are now actually up to about page 81 in the statement of evidence and we'll be a little selective here. I have broken these down into

two groups.

Principally our concern here operationally for timber production are the two uses that I have grouped in the top box and I've been referring to these at least indirectly up to this point. One is site preparation and I think the function of site preparation has been adequately describe before the Board.

Release and what I call prerelease, although this a term that I personally have attempted to introduce into the literature, thus far with fairly good acceptance, refers to releasing crop trees from competing vegetation that are interfering with the growth and development of the crop trees.

I would like to turn to prerelease, as I will try to illustrate for you that it's kind of like preventive medicine, that if you get the competition under control in a timely manner and thereby maintaining a positive growth momentum of the crop trees you can be more effective with the tending treatment and actually carry out the tending treatment at a lower cost per unit of treatment. So it becomes a very good practice that you get the most for the least and it is the most effective in being in concert with the biological system.

We always have to keep in mind we are dealing with a dynamic biological system here and we don't legislate or overpower the processes of photosynthesis and such, we have to work in concert with those.

In the second box are two other uses of herbicides that we make reference to in the evidence statement only briefly because the panel considered these to be somewhat secondary at this time in terms of the concerns of the Industry. These are thinning where herbicides can be used to carry out a thinning operation either pre-commercially or commercially, where individuals stems can be injected with a herbicide or where too many stems exist the number of stems can be reduced through a judicious use of herbicides.

It is a process which is effective, but it is not a broadly applied practice by the Industry across the area of the undertaking.

The other one listed there is No. 4, is rights-of-way. This is referring principally to road rights-of-way where herbicides are used to maintain those rights-of-way from the standpoint of the integrity of the roadbed and road structure, as well as safety.

Roads, in order to maintain their structure, must have stable shoulders which are often maintained through proper installation of drainage along the sides of the roads, and if brush and vegetation growth invades these ditches and impedes the drainage flow it begins to breakdown the integrity of the shoulders which then interferes with the structure of the road and interferes with the road bearing capability, as well as just the overall structure of the road.

Beyond that are the safety considerations of visibility, especially on inside curves and at intersections where it is important to have visibility. And in some cases where it is desirable to have sunlight reach the road, herbicides are a very effective tool in satisfying those things.

MS. CRONK: Dr. McCormack, before I invite you to elaborate further on the Industry's perspective of the use of herbicides, Madam Chair, I am conscious of the time.

Does the Board wish to take a morning break?

MADAM CHAIR: Yes, we can take our morning break now, Mr. Cronk, if it is convenient.

MS. CRONK: Thank you.

MADAM CHAIR: We will be back in 20 minutes.

MS. CRONK: Thank you.

---Recess at 10:10 a.m.

---On resuming at 10:30 a.m.:

MADAM CHAIR: Please be seated.

MS. CRONK: Q. Dr. McCormack, could I ask you to turn next then, if you would, please, to herbicides specifically as a form of tending technology and could you outline from the perspective of the Industry what the advantages and of the use of herbicides are?

DR. McCORMACK: A. Okay, we are now -- this would be No. 14 in the series of transparencies, This one addressing advantages of herbicides for vegetation management in timber production.

In this I am summarizing the main points that have been established now over a period of the preceding 40 years' experience with this technology. Less access is required. We can get out there and treat the areas and it is not as necessary to maintain roads or have direct access, especially with aerial application our capability is very far reaching without the additional costs and complications of maintaining access.

Going back to that time/area productivity ratio that I referred to earlier, this a tremendous advantage with herbicide technology because managers are able to treat operational size areas requiring tending within the time that is suitable for those treatments and within the time that is available to managers to carry out those tending activities, and this is a very important consideration in the technology as a realistic tool for timber managers.

Also going back to a concern for site disturbance. Where disturbance can be from an ecological standpoint detrimental, this technology enables us to treat these operational size areas, difficult terrain areas and such without a direct disturbance of the site and this can be extremely important in eliminating things like soil erosion or other similar disturbances to the site, stirring up the buried seed and so forth.

And from an ecologist's point of view, this next one is almost beautiful. It is subtle effectiveness. It isn't a drastic bang as if manually taking the brush out and falls across the desirable trees and full sunlight comes in, it happens over time. A properly prescribed herbicide treatment reduces the competition, it occurs over a period of time and things

happen gradually. So there isn't that sudden full sunlight, there are not these drastic potentially detrimental impacts on the crop trees.

This to me is one of the truly advantageous factors of herbicide use that fits into the ecosystem very well.

They are selective. Through different characteristics of the herbicide selectivity is carried out so that a manager can suppress the species that he or she wants to suppress and at the same time not carry out a tending treatment which is detrimental to the crop trees. So the selectivity is a real asset to managers and especially in pursuing that time/area ratio benefit.

With current technology and recent developments and those which we see coming along, there is a prescription flexibility. A timber manager doesn't do it or not do it, a timber manager can say: I need to carry out tending, what do I want to do, do I want to suppress these species and maintain a grassy cover, do I need to remove grassy competition or a wide variety of different situations? Conditions can be achieved through this flexibility, so there is a series of options within this alternative which are available.

Worker safety is well established in

terms of what are the risks to workers, what kind of safety considerations are there. The risks to workers are minimal as compared to the other alternatives when herbicide technology is used as an alternative of tending.

Then what's really neat when you sit in a front office and you have to decide what you are going to do or how much of it, that even with all these advantages and especially the subtlety within the eco-systems and the safety consideration of the alternatives, it is also the one that has the lowest cost. This, of course, provides some real economic flexibility as well.

Q. Dr. McCormack, I understand you will be dealing with the cost issue again subsequently in your evidence in a comparative sense for the Board?

A. Yes. I tried to summarize some costs, comparative costs and I am prepared to discuss various aspects of the costs as we proceed.

Q. Fine. Perhaps we will come back to that then. Turning next to a further option that you describe to the Board; that is, a combination of one or more techniques.

A. Now, this is an option that's often overlooked. This is now the 15th transparency and

refers to some summary information on page 82 of the statement of evidence.

If we look at these four principal alternatives that I have summarized, that there are some opportunities and advantages where combinations can be considered and, again, for the sake of discussion I show some possibilities here.

One that has puzzled me now for many years is the one illustrated by this arrow here going from manual to chemical, that by incorporating a judicious use of herbicides with a manual approach one can significantly reduce the need for re-entry. For example, where, as I pointed out in manual treatments, it resprouts, there's regrowth, we don't suppress the root system, that by combining with an appropriate targeted herbicide use that resprouting and regrowth can at least be minimized.

Q. Sorry, Dr. McCormack, did you say that that had puzzled you for years?

A. It puzzles me that where manual methods are used or it is a special site where manual methods might be most appropriate, that in order to gain full advantage of the effort which is carried out in doing this manual work you could carefully use the chemical treatment to a major step of a better --

toward a better job.

To me, where manual methods are the obvious way to go, it is a logical step where this can be carried out in a very safe manner to go one step toward a better job. There is very little additional cost since your major cost is the manual entry in the first place.

Q. Thank you.

A. Another that has been used in the Pacific northwest is certainly worth considering if there is a fair amount of green growing live plant material on a site that might be suitably treated with a prescribed burn. That vegetation can be put into a better fuel condition through the use of herbicides to prepare the fuel for a better burn to carry out the prescribed burning.

This is referred to in the practice of the Northwest as brown and burn. I'm not sure that's the way to refer to it, but in some of the silvicultural guidelines that's the way they refer to it, but it's a fuel preparation step that can be advantageous.

And then there is an interaction that I illustrate here in the diagram between mechanical and chemical and it can go either way. Where mechanical

treatments are carried out, chemical treatments can be incorporateed with those to provide a more complete treatment. For example, in site preparation or if there is a fair amount of plant material on a site and it is going to require a mechanical treatment, again likely for site preparation, a herbicide treatment preceding the mechanical treatment -- for example, a mechanical treatment might be necessary to reduce the organic bed, to redistribute the brush, but there is a fair amount of plant material there that could resprout and actually be a complicating factor, that a chemical treatment which precedes the mechanical, before the vegetation is disturbed and disrupted, can reduce the reinvasion of that vegetation that might otherwise have followed the mechanical treatment.

So there are three examples, possibly four of where combination methods can be employed to an advantage.

Q. Dr. McCormack, if we could stop there for a moment and if I could turn to the other members of the panel and those in particular from various Industry companies.

Mr. Smith, dealing with the case study presented by Abitibi-Price Inc. Lakehead Woodlands Division, is there an illustration in your case study

of the types of procedures that Dr. McCormack has been just discussing?

MR. SMITH: A. Yes, there is. In case study 4C we incorporated one chemical treatment with two mechanical treatments and the reason we did this was to simply enhance mechanical site preparation by using chemical site preparation in terms of increasing the effectiveness of the crushing, shearing process affiliated with the Marden chopper.

Q. Was the chemical done for tending or site preparation purposes?

A. In this case we had a pre-spray chemical site preparation and there also was an associated tending project.

Q. Will you be describing that later in your evidence today for the Board?

A. Yes, I will.

Q. Dr. McCormack, you have mentioned in an earlier context in the course of your evidence this morning those particular options which afford, to a greater or lesser degree, some flexibility to timber managers in carrying out tending operations.

What generally is the Industry's position regarding flexibility in terms of tending operations and generally regarding the need for alternatives with

respect to tending?

DR. McCORMACK: A. This subject is addressed in the first part, this is Section 3 of the statement of the evidence which begins on page 85, with a prepatory statement addressing the changing mill and end product demands and a variety of conditions that flexibility in tending and protection decision-making on a management unit is essential and it's critical that a range of cost effective management alternatives for tending and protection be available for timber managers.

Q. Dealing just with the tending aspects of that position, how, from your perspective based on your involvement with the Industry, is any particular tending method selected?

How does the manager go about assessing and choosing from the options that you have described to the Board?

A. Well, obviously at this level of decision-making there is a wide range of factors that can be considered, most of which essentially must be considered by managers. They are summarized there. I would like to elaborate more in my words about some of the things that form a basis for selecting an individual method.

Obviously at the onset one must have an objective of the treatment and that is the first step in determining where you go in making the choice. Since we are managing vegetation, the conditions of vegetation on a site become a major consideration and should be evaluated or at least known and understood by managers. These are things like the species which are present, how big are they, how well have they developed, how vigorous are they because things like the relative vigor condition of the target vegetation - by target vegetation I mean that which must be managed - it makes a difference as to how we would approach it.

What is its relative position in the stand? Is this competing vegetation taller and over-topping the crop trees or is it thick competing vegetation that surrounds the crop trees, what kind of differentials exist in their relative positions, and then here I bring in the term phenology and by phenology I'm referring to the biological condition of development through the seasonal sequence of this vegetation: Is its actively growing, it is harden off, has it formed buds, has it lost its leaves, is it early in the season and leafing out?

These types of conditions are important

to consider especially since they figure in, to some extent, the selectivity of a herbicide in that one wants the crop trees to be in a relatively stable conditions so it's less likely to be adversely effected by a herbicide, yet you want your target vegetation to be susceptible to the herbicide and there are differences across the herbicides that provide advantages and prescription development but also are critical to proper decision-making.

Similarly, even if one wants to look at this from the standpoint of manual treatments, ability of a sprouting species to resprout varies phenologically as well depending on the season in which it's carried out. So these types of things figure in.

Where are we with respect to ground cover? By this I mean vegetative ground cover because in some cases we might mant to make sure that we maintain it. From an ecological, minimal site disturbance standpoint we would want to maintain ground cover and if a manager decides that it is important to maintain that ground cover that will effect the way the prescription is developed.

I list a variety of physical factors summarizing some of these and soil conditions. There is risk of erosion, it's accessibility, how long is the

area; terrain, is it sloping, is it flat; if it is sloping terrain, are you at the top of the slope, the mid point of the slope or the bottom of the slope and where is that with respect to a stream, for example, a position of a water course needs to be considered.

Climatological considerations. We always have to deal with the weather, we have to fuction in a way that is compatible with whatever we want to carry out and thing like impending frost, risk of heavy rain storms, droughts or just dry periods, excessive moisture, a warm autumn season where growth might carry a little later into the season that usual. All these things have to be built in as well.

It probably goes without saying that you have to have sufficient labour and appropriate equipment to do whatever you decide to do. You must have appropriate equipment to carry it out. You don't carry out a ground application unless you have proper equipment properly installed. Similarly, you can't carry out an aerial application unless you have suitably equipped aircraft.

There are budgetary constraints, of course. Whatever it is has to be within the budget of operation and then one can go on and on about the variety of external constraints. I picked two by way

of example. One is regulations. You have to work within existing regulations with whatever the treatment prescription might be. Also, I mention things like proximity to sensitive areas.

Now, I use this term without respect to any definitions that have existed in these proceedings up to this point. The term sensitive area is one that I have used over the years, areas that are sensitive from an environmental standpoint that may need special consideration. It might be an eagle's nest, it might be a critical area of a watershed from which drinking water is obtained or an important salmon stream or whatever it might be, that these things are important and need to be considered in the development of tending decisions.

Q. In your experience, Dr. McCormack, are all of these factors matters which, to a greater or lesser extent, are taken into account by timber managers in choosing between tending options?

A. Very definitely so. It's a necessity.

Q. Well, turning specifically to the issue of the use of herbicides as a particular tending option, what again generally is the Industry's position regarding the need for the use of herbicides in tending

activities?

A. This is carried forth in Section 4 which begins on page 89 of the statement of evidence which starts off with a statement outlining the position of the Industry relative to the use of authorized herbicides in tending as being essential and an effective part of sound timber management and, accordingly, their continued use in appropriate circumstances and under regulatory control required to tend the timber resource and for that reason should be supported.

Q. What is your own view, Dr. McCormack, as to the need, if any, from your perspective and based on your experience for the use of herbicides in tending activities?

A. Well, I am a silviculturist and my real area of specialization over the years has been forest regeneration, that when I started my career in terms of science and research I was charged with studies of establishing regeneration and planting trees, getting them in place. Nobody every said go out and work with herbicides.

I began to pursue this and as I got into it, and having been been trained as a forest ecologist,

it became inescapable that the single biggest impediment to establishing desirable regeneration was competing vegetation and I found that for me to carry out my other work, relative to planting, stock characteristic, planting methods, fertilization, genetic tree improvement and all the other components of regeneration, I found the single most important prerequisite was management of competing vegetation and that my work with all those other components was less significant and, in some cases, almost meaningless unless I first controlled the competing vegetation.

So I have found in working with this over the years that that is the most important prerequisite and it is folly to intensively establish regeneration in the interest of a healthy productive forest without managing that competing vegetation. And I think this is reflected in Industry operations that I personally observed from Oregon across Ontario and on as far as Newfoundland.

Q. And you have described to the Board a number of options available by which tending can be carried out. Specifically with respect to our own experience, what is your view as to the need for the use of herbicides to achieve the vegetation control which you've described as being critical?

A. Well, that too has evolved over the years. If I may mention that one of the first chairman under which I worked in the research program said: You have identified the problem, solve it, but don't use any herbicides in the first three years. So I tried everything else I could try, everything that has every been suggested and I have gone full circle now a couple of times within my career, and in my opinion it comes down to the only true operational choice that is truly beneficial for the trees of concern on an operational scale is herbicide technology.

And I hope that some of the information that I have here to present before the Board will illustrate why I feel that way.

Q. Thank you. Turning specifically then and still dealing with the use of herbicides, could I ask you to address first the use of herbicides for site preparation?

We will come in a moment to release and what you have described as prerelease, but first with respect to site preparation involvement of herbicides, what based on your experience, Dr. McCormack, are the relative advantages and disadvantages of the use of herbicides for that purpose?

A. Okay. With this I will just kind of

put us back within the framework, I had the same list before the Board a little earlier. As I indicated, I don't plan to elaborate any further on these two items. I will address at this point site preparation and then spend considerable time on what I think Industry feels is the major concern here in release and prerelease.

I am certainly open to pursue any of these things if it is desirous of the Board, but we will start to zero in on these uses at this time.

In response, Ms. Cronk, to your request I will start with site preparation and refer to the figures using herbicides for site preparation, looking at some benefits and then some possible drawbacks as far as the use of herbicides.

As I point out as an advantage of herbicide use, we can carry out a treatment with minimal or no site disturbance and where ecologically the site disturbance is to be avoided that, of course, is a benefit.

Herbicides can be used as an adjunct to fire and/or mechanical treatments to more effectively employ those alternatives for site preparation, they allow us to bring onto a site a timely preventive treatment. A properly carried out site preparation treatment with herbicides is in the order of -- the

term I used earlier, similar to preventive medicine.

You kind of avoid the problem before it becomes a problem and that's a very efficient and effective way to go. And in incorporating chemicals into a site preparation program, especially where mechanical treatment has been necessary, we can provide some residual suppression of the competing vegetation.

This makes it an all-around better treatment and an example to keep in mind here would be equipment that goes in and carries out a mechanical site preparation treatment, but at the same time can apply herbicide with equipment -- application equipment mounted on that same equipment to more effectively carry through on mechanical site preparation.

Looking at the lower box where some of the complications are outlined, often it is necessary to have target vegetation in a regrowth condition to effectively treat. If there is no foliage present you don't have a treatable target and it would be disadvantageous to sit around and wait for that to happen. So there could be a timing complication there.

If there has been a fair amount of activity on the site which has disturbed the vegetation, then it is more difficult to treat with herbicides.

Other considerations that are specific to site preparation are that in the use of herbicides. There is likely no redistribution of residues that might be necessary to facilitate the planting effort and there is no reduction of excessively thick organic layers which also might be necessary to facilitate the planting of trees.

There are other considerations, these are the ones that I selected as the most important to summarize here for you this morning.

Q. Dealing next then with the use of herbicides for release or, as you have termed it, prerelease purposes. Again perhaps first, what is the Industry's position in that regard and what are the issues involved as you see them with the use of herbicides for release purposes?

A. Okay. Here is where I think we start to dig into more of the details and specifics relative to herbicide use. On page 96 of the statement of evidence is a statement representing Industry's position, that the use of herbicides for release and suppression of competition is the most practical method successfully controlling that competing vegetation in the area of the undertaking.

That is a fairly definitive statement

that actually, now that I read it again, is in line with my earlier personal statement about the importance of herbicide technology.

Q. Do I take from that, Dr. McCormack, that you are in agreement with that position put forward by the Industry at this hearing?

A. I definitely am. Of course I wouldn't stand up here with it in front of me if I didn't agree with it, yes.

Q. And what, dealing specifically with the use of herbicide for release or prerelease purposes, are the issues as you see them? What are the considerations?

A. Okay. There are several things and this is where a variety of topics will be considered.

I would first like to address one aspect of using these treatments in the best way for timber production and it's a very important principle, it is one that has been somewhat slow to sink in to some practitioners minds, but it is now well established.

It is outlined within some of the statement of evidence, it's thoroughly discussed in the reference edited by Walstad that has been referred to in our statement of evidence and I have a set of curves here, which will be my transparency No. 22, which I've

developed if an effort to illustrate this relationship.

It's a simple diagram that shows conifer regrowth or growth and development increasing on the vertical axis. These are the crop trees. And then across the horizontal axis is the time since the disturbance, which is harvesting or site preparation. And there is a curve which then separates into three parts.

Growth usually starts out slowly, begins to increase and it's at this point that the more rapid growth rates begin to be reached by the crop trees and we have that best growth momentum to which I have referred, that timely release can be carried out. So that this growth momentum is maintained.

Back in the old days a manager would go out and look and say: Well, my crops trees haven't really slowed down much so I don't need to release them yet, and we have learned that if you wait until the crop trees slow down you have lost part of your advantage and you are not able to do as good a job.

So it is important, as indicated here, that a timely release enables the manager to maintain the best possible growth and development of the crop trees that I highlight here with green.

That doesn't mean that all is lost. As

growth starts to slow down, as long as serious impacts on the vigor and development of the crop trees have not occurred, release can still be carried out, but from a best possible result it has to be considered late and it is not going to be as good as the timely release, but it would be possible to still maintain a reasonable growth rate and momentum. It is likely with most of the crop tree species in the area of the undertaking that if you accomplish what I illustrate here as late release you will never quite regain that position of growth rate and dominance that would have been achieved by a timely release.

So this shows where timing really becomes important and then, of course, the other option that's illustrated here in the third curve is if you didn't release at all the growth rate begins to drop off, the crop trees lose their vigor, can actually be lost and begin to drop out so that stocking losses begin to occur as yet another loss beyond the loss of growth rate.

So this relationship of timing and the importance of maintaining growth momentum is a critical consideration.

Q. Dr. McCormack, just looking at that graph for a moment, can you from it make any

observations regarding bringing the new forest into production, if I could term it that way, for wood supply purposes? Would these relationships assist you in --

A. I think the Board has been introduced to the new forest/old forest concept and the need in order to satisfy timber supplies of accelerating, the bring on line of the new forest.

That would be best represented by my green line here and one of the managers best options to improve the condition and accelerate the bringing on line of the new forest is this technology. And I think some of my growth response data that will come up later will help to illustrate this further. Very definitely an important silvicultural practice. Many industrial people across North American feel it the single most important step in bringing the new forest on line.

Q. Could you turn specifically then to the mode of application, aerial application of herbicides versus ground application and I am going to ask you to start first with aerial application.

Would you outline for the Board, please, again from the Industry's perspective, and in particular based on your experience, what the respective advantages and disadvantages of the aerial

application of herbicides are?

A. Certainly. These are outlined on page 104 through 107 of the statement of the evidence and I have some highlights listed on what is my transparency No. 23 addressing aerial application, looking at advantages and some of the constraints.

I think, as is shown and will be emphasised in the statement of the evidence, that this is a major method by which tending is carried out. Aerial within the technology provides the best means of treating those areas which are not directly accessible, and by that I use the term here remote, and to treat areas that are of an operationally realistic size, that truly operationally sized areas can be treated in this manner.

It is an established technology. There is a great deal of experience that has developed and sometimes I am almost overwhelmed by this that -- for example, just two years ago, in working on some spray delivery system developments of booms and nozzles, the pilot with whom I was working and flying with in the helicopter was one of the same pilots that sprayed herbicides on woodlots for woodlot improvement in the State of Maine in 1947, and I have worked with this man over the last three years and have had the benefit of

the development of the technology since 1947 and his personal experience with it. And this I think is pretty unique and we are able to take this technology and we've worked on it and polished it so that it is well established, quite manageable and predictable.

Aerially we can get effective uniform coverage. We are able to distribute an application pattern effectively, uniformly and consistently and in so doing we avoid the site disturbance that I have already referred to. I think it goes without saying after my earlier comments that our area treated within the time window available/efficiency ratio is outstanding in this case and as we perfect the equipment we even improve on this capability.

On a cost per unit of managed land area there are distinct cost advantages. We can carry out this effective uniform treatment and do so at the lowest cost for such a generic tending treatment. Aerially we are able to accomplish all this with less herbicide than any of the other herbicide alternatives and that, of course, has several implications.

One is a cost in that in applying herbicides the cost of the chemical itself is probably the most significant component and anything we can do to reduce the amount of chemical reduces the cost.

Similarly, as a general rule, managers are committed to using the least amount of chemical possible just as a matter principle.

Q. What do you mean, Dr. McCormack, when you say that with aerial application methods less chemical is required? Less than what, what are you comparing it with?

A. Less than would be required in any other option involving herbicides, for example, ground application. A manager can achieve an equivalent or better level of success in tending through aerial applications with less chemical.

I don't think that came out quite right. But to achieve a given level of suppression of the competing vegetation, this can be achieved with less herbicide as compared to ground application through aerial application of that given amount of herbicide.

Did that come out right?

Q. Thank you. I understood I think what you meant. Continuing then with your list.

A. Okay. And with this is the important aspect of occupational safety. With all our many years of experience with this technology, it is proven that in terms of safety it's a good secure way to go.

Q. Again, Dr. McCormack, compared to

what?

A. Compared to the other alternatives for tending, especially in the case of ground application, but also one looks at worker safety in the other alternatives, for example, manual tending.

Q. Are there as well, however, disadvantages in your view to the aerial use of herbicides in timber management?

A. Well, there are some constraints.

Q. What are they?

A. And I have summarized those that I would consider to be the most important to put on such a list. The first one being public sentiment. This, of course, is the difficult one to address because it involves a fair amount of emotion, but the public sentiment is there, it is public sentiment that drives the regulatory process; thus, constraints result because of this.

Some of the practice standards, guidelines and regulations define buffer areas that relate to critical or sensitive, however you want to define these, for a variety of reasons that are usually defined in most legislative jurisdiction across North America where buffers are specified to minimize or eliminate the possibility of off target movement of

herbicide into such a critical or sensitive area.

In so doing, if these land areas are important as part of the timber production scheme, to me it is always interesting to sit down and calculate the land areas that are tied up when buffers are defined and in that respect it becomes important to be as secure as possible in defining those buffers so that a minimal amount of productive land is lost in the buffers.

Q. You use the term with respect to that factor, Dr. McCormack, looking behind you, critical area. What do you mean by that term?

A. Well, again, I use this generically as I did sensitive area. This would be perhaps some area of special interest to the public. It could be a populated settlement, it could be a critical water course.

Q. Is there any distinction in the way that you have used the terms between sensitive area on the one hand and critical on the other?

A. Probably not, that they are both somewhat generic in referring to areas that need special consideration. We tend to use the term critical area in my region because of a legislative definition that just says these are ones that make it

possible for special consideration, but they could just as well be sensitive areas.

Q. Could you relate then what you have said about the aerial application of herbicides to the ground application of herbicides and outline for the Board, please, what you regard and what the Industry regards as being the respective advantages and disadvantages of ground application use of herbicides?

A. Sure. One that is still on this list--

Q. I'm sorry.

A. --that really applies to both, but it can be important, especially in aerial application, is the spray window. You can't just go out there any time of year and do it. It has to be the right timing and that ties into some phenological considerations.

But going on to a specific consideration of ground application, because in discussions of this type it usually comes down to discussing and comparing ground versus aerial and this has been a frequently discussed topic and certainly an area that many of us have worked with to a great extent, ground application does allow managers to do a few things that are kind of special.

If it is a small area that needs special

consideration and is accessible, ground application provides some capabilities to the manager. And, of course, if there is no aircraft capability handy and it is a small enough area that it can be treated efficiently from the ground and is accessible, it's certainly a viable alternative for timber managers.

Ground application allows managers to do intensive targetting, putting the material exactly where they want to put it. That's especially true -- maybe it is backpack type application equipment in a seed orchard, for example, where that type of intensive targetting is needed.

Another possibility for managers that I referred to a little earlier talking about site preparation is that if you are going to have mechanical equipment on the site carrying out site preparation, it can often be a very efficient procedure to mount herbicide application equipment on that same mechanical equipment that's doing the site preparation so that this can be carried out in conjunction with the mechanical site preparation, and it would be a prudent move on the part of the manager to do it in that manner.

Then going on with ground application, because it involves herbicides we are still faced with

the public sentiment and the concerns that go with public sentiment and this, of course, is an integral part to carrying out these treatments.

Access is required. You can't do it if you can't get the equipment on the site. Compared to aerial, the productive is relatively low. The amount of land area which can be treated from the ground is lower quantities; the productivity is just not as much as that which can be achieved from the air. That then builds in some limitations and, from an operational standpoint, how much a manager can carry out.

There is going to be ground disturbance and that includes disturbance of the target vegetation. If, for example, you go in with a ground application, perhaps a skidder mounted apparatus, and drive through an area attempting to spray the area from the ground, you can come back within the next growing season and track the course of the vehicle because the vegetation which is disturbed by that ground application vehicle is not as susceptible to treatment and you will see green tracks, and you will see what is in some regions a potential for a more rapid reinvasion of the site by the undesirable vegetation because of that ground disturbance.

With this goes a more inconsistent

application because one can calibrate and uniformly apply a treatment from the air because the aircraft can fly in straight lights across the treatment area when that is extremely difficult for a skidder, forwarder, whatever type of equipment is used for ground application.

In that respect I have personally observed countless cases of inconsistent delivery of the treatment and if I were to sit down and try and list out all the herbicides spills with which I am personal familiar over the last 20 years, with the exception of one problem with a batch truck, they have all been ground application because it is difficult for the ground equipment to move across sites that require treatment without disturbing things and in the process stumps or boulders or such, in an effort to deliver a consistent spray pattern, results in a spill and in several cases overturning of the application equipment. In the process of doing this to cover that target more herbicide is required to achieve the silvicultural objective and a much larger spray volume is also required.

So you have to move more material, you have to do more mixing, you have a logistical problem which are more complex and more difficult to handle on

the operational scene.

And with that, and as I mentioned things like equipment turning over and worker exposure, one has to consider there are higher risk of worker exposure and safety. I have worked with many groups, industrial groups, regulatory groups over the years and it's unfortunate but one of the greatest misconceptions in that delivery of herbicide technology is the idea that ground application is safer and more sound. This simply is not the case. We can deliver a pattern of less chemical, more securely and more precisely from the air than we have ever been able to come close to from the ground.

I'm happy to say that many groups, including pesticide boards which would include the Pesticide Board of the Province of New Brunswick, have come to recognize this and see the advantages and the security that's inherent in aerial application as compared to ground application.

Q. Dr. McCormack, just dealing with this issue for a moment. Based on what you have just said and based on your experience generally, what would be your view as to the proposition that timber managers in the area of the undertaking should, in the future in using herbicides for timber management purposes, be

restricted to ground application methods only?

A. I think Ontario is especially unique, as I am familiar with the area of the undertaking, that the extent of the areas and sizes of the areas are such that it would not be possible to do a responsible job of tending without aerial application. It just would not be workable.

Q. Why do you say that?

A. Because of the need to apply secure, uniform treatments over relatively large operational areas. That tending objective could not be achieved with ground equipment.

And I think from the standpoint of responsibility to the ecosystem, the fact that we can carry out these tending treatments with less disturbance, with less chemical, do it more effectively within those dimensions in time periods that are more manageable and predictable all support the need of aerial application for timber managers in the area of the undertaking.

Q. Are your remarks in that regard confined to tending applications or do they extend to the use of herbicides for site preparation purposes?

A. Well, in a general way they apply to site preparation but, as I pointed out, if there is a

need for the advantages of mechanical site preparation such as reducing the organic bed, then it might be the most effective and efficient way to utilize ground equipment in that type of an operational situation.

Now, if the site is such that it is suitable for planting and you do not need to modify residues or organic bed, then the choice where aircraft delivery capability exists is to do it aerially. You can't do a better, more precise job.

Q. Well, may I put the proposition to you this way: If it were proposed with respect to site preparation that when it was regarded as -- I'm sorry, let me rephrase the question.

With respect to site preparation alone, if it were proposed to the Board that in the future timber managers in the area of the undertaking, if they are going to use herbicides for site preparation methods -- site preparation purposes should be confined to the ground application of herbicides, would you regard that as appropriate or inappropriate?

A. I would consider that to be very restrictive on a manager because there will be places where, without question, aerial would be the best way to go.

If the manager is restricted to only

ground, it would mean more ground disturbance, more use of chemical and higher costs to the manager. And when we have an established capability to avoid those detrimental effects and disadvantages, it would be a shame to deprive a manager of that capability.

Q. Thank you, Dr. McCormack.

I would like to turn for a moment to Mr. Stanclik and if I could ask you perhaps just to have a seat, Dr. McCormack, for next few minutes.

MS. CRONK: Madam Chair, Mr. Martel, in light of the evidence that Dr. McCormack has given, I wish now to invite Mr. Stanclik, on behalf of the Ontario Industry representatives on the panel, to outline for the Board the exact extent of herbicide usage by the Industry in the area of the undertaking and Mr. Stanclik will be referring to a number of revised tables that were originally contained in the statement of the evidence. The revised tables formed part of Exhibit 1132.

MR. STANCLIK: They are almost at the very back of 1132.

MADAM CHAIR: Are those tables, 4, 5...

MR. STANCLIK: Yes.

MS. CRONK: Beginning at Table 1, Madam Chair.

Q. Mr. Stanclik, then, dealing with the actual practices of the Industry in the area of the undertaking with respect to herbicides, could you outline for the Board first, if you would, please, the type of herbicides used by the Industry?

MR. STANCLIK: A. Madam Chair, in this section of the Industry's evidence I will review the Industry's use of herbicides in forest management on Crown land in Ontario and in particular the area of the undertaking.

Most herbicide usage by Industry in forest management on Crown lands in Ontario is by companies that have forest management agreements with the province. I have seven overheads to review the status of this activity since the start of the forest management agreements in 1980.

And, as Ms. Cronk said, this is the first overhead I have. It is of the herbicides that are registered and approved for use in Ontario. As you can see there are five herbicides 2,4-D, glyphosate, hexazinone, simazine and picloram. The last two, simazine and picloram are not used on an operational scale by any of the 30 FMAs.

The table also shows that hexazinone is only registered for ground application for both site

preparation and conifer release in the area of the undertaking. The two herbicides most commonly used are 2,4-D and glyphosate, both of which are approved for site preparation and conifer release by either ground or aerial means.

Q. And for the record, Table 3 to which you have just referred appears at page 101 of the statement of evidence, Panel 7.

Dealing with site preparation then first, Mr. Stanclik, can you outline for the Board, please, what the actual use by the Industry is of chemical herbicides for site preparation purposes?

A. The next three overheads deal with site preparation. This first is a graphical representation of the data in Table 1 on page 93 of the witness statement as revised in the errata.

This is a summary by year of the area of FMA Crown lands treated with herbicides by Industry for site preparation purposes.

MS. CRONK: And, Mr. Stanclik, before you go further with this table, copies of the tables drawn from the information in the statement of evidence, Madam Chair, were provided the first day that this panel commenced its evidence.

If I may have a moment I can give you the

exhibit number.

MR. STANCLIK: Exhibit 1133.

MS. CRONK: Thank you. Exhibit 1133.

Q. Sorry, Mr. Stanclik, I interrupted you.

With respect to Table 1 that you have just put up forming part of the photocopied overheads contained in Exhibit 1133, what is this, please?

MR. STANCLIK: A. This is a summary by year of the area of FMA Crown lands treated with herbicides by Industry for site preparation purposes. The data comes from the 30 FMAs now in place in the province. Of these, 24 FMAs have to date carried out herbicide treatments for the purpose of site preparation.

Industry usage on Crown lands began with the signing of the FMAs starting in 1980. Prior to the FMAs, all herbicide usage on Crown land was done by the MNR.

As you can see from the table, there was no chemical site preparation done by Industry in 1980. This is due to the lead time required to prepare a spray program. The FMAs only came into effect in April of 1980 which only left two months before the start of the spray season.

As you can see from the graph there is an increase over time in the amount of chemical site preparation that has taken place. Basically this increase was due to two major factors: The shift of the renewal responsibility from MNR to Industry with the signing of the FMAs in 1980. As more FMAs were signed, a greater percentage of the provinicial renewal program was being carried out by Industry.

No. 2, expansion of the size of the forest renewal program which took place in the province over the same time period, chemical site preparation being a component part of some renewal treatments.

Two other factors contributed to the increase. No. 1, changes in technique which incorporated chemical site preparation as a component part of an overall treatment, for example, the use of chemical site preparation on vegetation prior to prescribe burns particularly on lower, wetter sites to improve the quality of the burn; and, No. 2, the rationalization of implementing intensive regeneration techniques on the most productive sites where the greatest return on investment can be made, but at the same time competition problem is also the greatest resulting in the decision to pretreat some sites with chemical site preparation prior to planting.

The total area treated on an annual basis has been similar for the last two years.

Q. You are pointing to 1988 and 1989?

A. 1988 and 1989. It is anticipated that the annual level of chemical site preparation by Industry will increase more gradually in the future now that most existing FMAs are close to being fully implemented. At some point we will probably level off unless the provincial renewal effort is extended further.

Chemical site preparation is usually used in association with another site preparation technique, such as mechanical site preparation. A reasonable estimate would be that this association exists in over 90 per cent of the cases.

Q. Mr. Stanclik, if I could just stop you there. At the scoping session held with respect to this panel's evidence, a number of questions were raised regarding the tables in the statement of evidence on the Industry usage of herbicides.

Just dealing with this table, chemical site preparation usage, could you elaborate for me or explain why it is that there is no usage shown by the Industry in 1980 or prior to that year?

A. As I have said earlier, in 1980 the

FMAs were just being instituted in April of that year and it takes quite a long time to put together a spray program and process it through at various levels of government to get it approved to be instituted.

Now, the FMAs came into effect in April of '80 and the spray programs would have started in July or August of 1980, but to prepare a program you would have to submit your application with the annual work schedule which would have been in the fall of the previous year.

Prior to 1980, the Industry had no activities on -- no responsibility for any tending or site preparation activities on the Crown licences at that time.

Q. Does this table and the others associated with it deal with chemical site preparation overall on Crown lands in the area of the undertaking or simply that carried out by Industry representatives?

A. It's strictly by Industry representatives on the 30 FMAs that are in place.

Q. Now, bearing in mind what you have said about the Industry's role prior to 1980 in this context, in the circumstances of carrying out site preparation by chemical or other means, were herbicides in use in forestry prior to 1980 albeit not by the

Industry?

A. My understanding is that herbicides have been in use in the Province of Ontario for at least 30 years.

Q. And does that extend to site preparation use as well?

A. That I'm not sure of, but I suspect that would be the case.

Q. And still looking at Table 1 and specifically the statistics in it, there appears to have been less use of herbicides for chemical site preparation purposes in 1984 than in the other nine years of the last decade. Can you assist the Board as to why that is the case?

A. Yes, this anomaly here is due to the fact that two companies or two FMAs in particular were using chemical site preparation in 1982 and '83 at fairly high levels.

The reason for this being -- the reason for the change being in 1984, in these two years, one FMA was using 2,4-D for site preparation prior to planting. With the availability of glyphosate in 1984, the technique was changed because of the wide range of competing species on the site and the company FMA went from pre-treatment with 2,4-D to chemical release the

year after planting with glyphosate.

In the second case, the other FMA was in a particularly difficult area to treat which required pre-treatment with a herbicide and this was NSR lands that were catching up on and the work was completed in '83. Subsequently their activity shifted to another area of the FMA that was not as competitive and did not require that type of pre-treatment.

Had those two companies not carried out activities in these two years, this would be quite a flat line here, then you would have an increase at this point.

Q. The flat line being from 1981 to 1984?

A. 1981 to 1984, yes.

Q. Thank you. And I think you indicated this, Mr. Stanclik, and if you did I apologize for asking you to repeat it, but a question was raised by the Board at the scoping session concerning the percentage of the area that was treated for site preparation purposes by the use of chemicals in combination with other site preparation methods, and can you help with respect to that feature of this table?

A. Yes, this is just an estimate, but as

I mentioned before, chemical site preparation is usually used in combination with some other form of site preparation and it would be our estimate that this association exists in 90 per cent of the cases.

So it's not too often that you use a chemical site preparation treatment and then subsequently plant without also using something like prescribed burning or mechanical treatment.

Q. And can you assist the Board, with respect to chemical site preparation, on the nature of the products used by the Industry during this time period?

A. Yes. This next overhead is a graphical representation of the data in Table 4 which can be found on page 102 of the witness statement as revised in the errata.

This is a summary of Industry herbicide usage on FMA Crown lands for site preparation by product used. As you can see from the graph, prior to 1985 all chemical site preparation was done using 2,4-D.

In 1984 glyphosate was approved for site preparation by both aerial and ground application methods. In the same year hexazinone was approved for site preparation use in forestry by ground application

methods only. There appears to be an anomaly in the level of use of hexazinone in '86. That's this block here (indicating).

Q. You are referring to the bottom of the tree block?

A. The bottom of '86 identified as hexazinone use. This higher level is due primarily to two sets of operational trials.

One set of trials was sponsored by the Canadian Forestry Service in support of mechanical broadcast ground sprayer, and the second trials were sponsored by a forestry consulting firm in support of a piece of site preparation equipment, the Bracke herbicider which is a patch scarifier but, in addition, sprays the scarified patch with a herbicide.

Q. Can you break that down in a different respect, Mr. Stanclik, and outline for the Board how these chemicals were applied for site preparation purposes?

A. Yes, I can. The next overhead is the method of application. This is a graphical representation of the data in Table 6 on page 105 of the witness statement as revised in the errata. This is a summary of Industry herbicide usage on FMA Crown lands for site preparation purposes presented by method

of application.

Again, prior to 1985, all chemical site preparation done by Industry was done aerially. Since then, ground application of herbicides for site preparation has been developing for specific treatment situations.

The anomaly in 1986, which I mentioned before with regard to the use of hexazinone, two sets of trials, appears here with larger than normal usage level by ground methods.

Q. And leaving aside then 1986 and the proportion of ground application attributable to the hexazinone trials, in the years 1987 through to 1989, does this table indicate an increase in the use of ground application methods for site preparation purposes?

A. There is an increase under special circumstances which I will discuss later.

Q. All right, thank you. Could you turn then to the companion information with respect to the use of herbicides by the Industry for release purposes and, again, could you outline first for the Board, please, the extent of the use of herbicides for release purposes over the last 10 years?

A. Okay. The first overhead is a

graphical representation of the data presented in Table 2 on page 98 of the witness statement as revised in the errata.

This a summary of FMA Crown lands treated by Industry in the area of the undertaking for conifer release for prevention of conifer suppression since the inception of FMAs in 1980.

As with the data on chemical site preparation, the area of treatment by Industry increased over time as more and more FMAs became fully implemented and also as the level of renewal in the province increased. Similarly to chemical site preparation, no chemical tending was done in 1980 because of the lead time required to prepare a tending program. Also, as with chemical site preparation, the annual total of area treated is expected to rise more gradually in the future.

Q. Why is that?

A. As the newest FMAss become fully implemented and the older FMAs complete their commitments on backlog areas and reduce the size of their programs, it is anticipated that the level of renewal -- release treatment will level off.

Q. And, again, can you break that down in a different way to outline for the Board and

identity the products used for release purposes by the Industry?

A. Yes, I can. The second overhead in this set is a graphical representation of the data in Table 5 on page 103 of the witness statement as revised in the errata.

This is a summary of Industry herbicide usage on FMA Crown lands for conifer release and prevention of conifer suppression by product used.

With the approval of glyphosate for conifer release in 1980, the percentage of conifer release done with 2,4-D has declined. You can see that the bar chart is going like this. (indicating)

Q. You are showing --

A. It rises from 1981 to a peak around 1985 and then subsequently declines to 1989.

Q. Thank you.

A. This is due to the forest manager selecting the most appropriate herbicide available for a particular species site, combinations he or she has to deal with.

With the approval of glyphosate in 1984, corresponding increases arise from '84 through 1989 in the use of glyphosate. This graph doesn't show glyphosate use in '82 and '83; however, a small number

of hectares totaling 42 were actually treated in those two years. These were trials carried out under research permits in support of registration.

Q. And if we look at the revised Table 5 provided with the errata to the statement of evidence, do we see the breakdown of the number of hectares treated by glyphosate in those years in experimental trials?

A. Yes, we do. In 1982 there were 16 hectares treated aerially with glyphosate, in 1983 there were 26 hectares treated aerially with glyphosate.

Q. I thought you said a few moments ago that glyphosate became registered for use in 1984. How is it that there was usage in the prior two years of that chemical?

A. These were trials carried out under research permits in support of registration.

Q. All right. And I also see on the revised Table 5 mention of hexazinone use in 1985 through to 1988. Looking at the graphical version of Table 5 can you help me as to how that usage is depicted on the graph?

A. Yes. The numbers are so small in relation to the other two chemicals that, in effect, it

does not appear on the graph, although there were some. Starting in 1985 there were 14 hectares of hexazinone, in '86 there were three hectares, in '87 there were 26, in '88 there were three and in '89 there were no usage.

Q. Overall what was the percentage of the use of hexazinone for those purposes in those years?

A. Overall the percentage of hexazinone use was less than one-tenth of one per cent for conifer release.

Q. And I am looking as well, Mr. Stanclik, just before you leave this table, at a title appearing at the bottom regarding -- it reads:

"Industry herbicide usage on FMA Crown lands for conifer release from competing vegetation..." and the next part reads: "and for prevention of conifer suppression..." product used.

You have heard Dr. McCormack's evidence this morning concerning his use of the term prerelease and what he means by that, does the latter part of the title of this table refer to the same concept or to something different?

A. Yes, it refers to exactly what Dr. McCormack has said.

Q. Thank you. And then finally, can you break this down in a different way and indicate to the Board the method of application used for release and prerelease purposes in these years by Industry?

A. Yes, I can. The last overhead in the set is a graphical representation of the data in Table 7 on page 106 of the witness statement as revised in the errata.

This overhead summarizes Industry herbicide usage on FMA Crown lands for conifer release and prevention of conifer suppression by method of application.

The data shows quite clearly that the method of choice in the past has been aerial application. Prior to 1985, 100 per cent of the chemical release work done by Industry was done aerially. From 1985 onward, some ground application has taken place. You again should see the darker image on the '86, '87, '88 and '89 data here.

Most notably, the majority of the release work has been the use of backpack sprayers that carry out partial release of white spruce plantations. This type of work provides needed release from competition, but the partial release also protects the white spruce from frost damage that may occur over the complete

removal of cover.

No mechanized ground spray has been used to release the crop trees we are trying to protect, primarily because of the damage that results to the crop trees over which the machine must pass. Aerial application is expected to remain the method of choice in the future in the area of the undertaking for reasons that will discussed later in this panel.

Ground application will be used where conditions warrant.

Q. All right. Perhaps I could put this question to the panel as a whole and to the company representatives on the panel.

Table 7 just described by Mr. Stanclik to the Board clearly indicates an overwhelming preference for the aerial application of herbicides by Industry for release and prerelease purposes.

Perhaps I could start with you, Mr. Ferguson. In your experience why is that the case?

MR. FERGUSON: A. There would be a number of reasons for that. Dr. McCormack in his evidence earlier outlined some of the advantages and disadvantages of aerial versus ground applications. I would certainly agree with Dr. McCormack's observation on that.

One of the major reasons I think that we would prefer the aerial application is, as both Dr. McCormack and Mr. Stanclik have indicated, the risk of damage to the crop trees is eliminated as opposed to ground application.

Another consideration would be the spray window, the actual time frame that is available to conduct herbicide release activities in particular, that being limited to approximately a one-month period. It is just not physically possible to accomplish this type of release on the scale that Industry wishes to do using ground application.

Mechanical ground application equipment would be able to achieve release of, I would suggest, maybe 10 to 12 hectares per day at maximum. Aerial applications could conceivably do 2- to 300 hectares in the same area.

Another consideration would be the capital investment that would be involved in having enough ground application available -- ground application equipment available and only being able to use that for approximately a month of the year. Aerial application equipment is available. There are a number of contractors well set up to come in and do aerial release work, aerial site prep work.

These aerial contractors are in the business full time, they work elsewhere throughout the year, possibly in insecticide applications elsewhere. To a large extent they are involved in agricultural activities, through the winter months they may be involved in seeding activities in forestry. The technology is very, very similar.

And I guess the other factor which must be considered is of course the cost factor. It's much more economical to apply herbicides from the air than from the ground.

Those are a few of the reasons and certainly Dr. McCormack has indicated a number more why preference would be aerial application.

Q. All right. Gentlemen, again the question is to the other company representatives on the panel who have experience in the operational use of herbicides for release purposes.

Are there any reasons apart from those dealt with by Mr. Ferguson for the Industry's preferred use of aerial application technology apart from those outlined by Mr. Ferguson?

MR. SMITH: A. I would like to add that one major consideration with our company would be less occupational exposure; in other words, we feel that

aerial application of herbicides is a safer alternative.

Looking at it in terms of productivity, some of the past work that we have done in the division indicated that our aerial application rates would be anywhere from two to three hectares per hour versus 150 hectares per hour with aerial application equipment and certainly --

Q. Sorry, could I have that again, please? Could you say that again?

A. Looking at it in terms of ratio of the productivity, we have done some ground application work and when you are dealing with an urgency in terms of getting in there and treating the plantation in a very narrow window, our ground application technology is running two to three hectares maximum per hour where aerial application would be 150 hectares per hour depending on the proximity of the land strip on the spray site. That is a major consideration.

Q. Thank you, Mr. Smith.

MS. CRONK: I apologize, Mr. Martel, Madam Chair, I missed the time. Would this be an appropriate time to rise for the lunch break?

MADAM CHAIR: It would be for the Board.

MS. CRONK: Thank you.

MADAM CHAIR: Thank you. We will be back at 1:45.

---Luncheon recess at 12:10 p.m.

---On resuming at 1:45 p.m.:

MADAM CHAIR: Please be seated.

Ms. Cronk?

MS. CRONK: Thank you, Madam Chair.

Q. Mr. Stanclik, just before the Board rose for the break you had reviewed a number of tables indicating the extent to which herbicides are in use by the Industry in the area of the undertaking.

And, as the Board will recall, a revised set of tables was provided with an errata as an exhibit last day.

Can you help me, Mr. Stanclik, as to why the revisions were necessary to these tables?

MR. STANCLIK: A. When the data from the questionnaire was compiled the first time two errors were included in the compilation. For one FMA for the years '84 to '88 some of the data arrived in a format that was different from the questionnaire and, as a result, some of the hectares were double counted. The correction was to remove those hectares from the appropriate categories.

The second error occurred with some 1989

data from another FMA where 2,671 hectares of aerial application of glyphosate for release was inadvertently entered as 2,4-D ground spray site preparation which are completely different categories and unrelated.

Q. Do the tables as revised reflect the adjustments to correct those two errors?

A. Yes, they do.

Q. Thank you. Gentlemen, I would like to turn now, if we could, please, to the case studies before the Board, Exhibit 1100, and I am going to ask each of you in turn to outline for the Board, having regard to the matters discussed by Dr. McCormack in his evidence this morning, to outline for the Board the nature of the tending activities undertaken in your respective case studies and the matters that were taken into account in arriving at the decision of whether to tend and how to tend and, Mr. Bunce, perhaps we could start with you.

As I understand it, you will be dealing with case study 4B, the E.B. Eddy Forest Products Limited case study; is that correct?

MR. BUNCE: A. That's correct. As you may recall, the case study 4B was presented in the overview by Mr. Waddell. The case study pertains to the jack pine/aspen upland mixed wood cover type and I

have some slides that I would like to show as I am going through this.

Q. To assist the Board, as I understand it, all the slides to which the witnesses will be referring with respect to the case studies this afternoon are from the original photograph binder of photographs, Exhibit 1101, I believe that went in with the case study.

A. I am sure by now that you are getting quite familiar with the location of the case study areas; however, the first slide that I have which has been submitted as Exhibit 1112 shows the general area of the Upper Spanish Forest located in the northern region in the Chapleau District of the Ministry of Natural Resources. That is the Upper Spanish Forest FMA 500/400.

The second slide -- I'm sorry, the first slide was Exhibit 1112 and the second slide is 1113 which gives you a closer look at the case study area on the border of Kelso and Ivy Townships, four blocks, total area of 28 hectares, approximately eight kilometres from E.B. Eddy's Camp 12.

The next slide is actually part of Exhibit 1132. It shows the tending alternatives that we considered when doing our release program, the first

being aerial spraying either with fixed-wing or rotary aircraft; ground spray with a skidder pulled sprayer, manual release with herbicides, such as a brush saw with applicator or packback saw; manual release without herbicides, such as a brush saw or a sand pick and no tending.

Q. Sorry, what's a sand pick?

A. A sand pick is somewhat like an ax only is has a removable blade. It is made for chopping down small trees.

The next slide is from the case study and it is No. 8.2 and reflects the alternative chosen both in 1984 and in 1986, which was the aerial application of 2,4-D using a helicopter.

Two treatments are normal on productive sites of this type where jack pine is the crop tree and this is somewhat indicated in the prescription, as shown in Table 1 which is an appendix to the case study area, which are the silvicultural specifications and standards. In there it states that tending will probably be necessary in the third and fifth years and that is both for the aspen working group when you are converting to jack pine or the jack pine working group when cutting for a jack pine crop on these sites -- this particular site.

Some of the rationale for the choice is shown in this slide, the first being that the case study area was only a very small portion of the area requiring tending in 1984 and 1986 and aerial application has the capability of handling programs of this size.

The second is the residuals and slash. Especially in blocks C and D where the residual trees have not been removed at the time of site preparation, this would effect the application of herbicides with ground equipment as described earlier because it's very hard to keep a uniform speed or straight line when you have to move around slash or up little hills or around residual trees.

Q. And just if I could stop you there, Mr. Bunce, just for a moment. The Board has heard about these four blocks in previous testimony. Were blocks C and D the two on which windrowing occurred or the two on which the poplar was left standing?

A. Sorry. Blocks A and B were blocks in which the site preparation included the removal or windrowing of the aspen; blocks C and D, which I referred to, the aspen was left standing and site preparation was done...

Q. Thank you.

A. Another concern is the mechanical damage which is evident when trying to use a skidder going through areas where you have a crop that's already established, and also when you are using brush saws in areas where the aspen suckering are thick it is very hard to see the crop tree and there's a very good chance that you can also damage or severe the crop tree at the same time. Also, the aerial application of herbicides is the most cost effective method of application.

The final choice, which was no tending, would leave the survival and growth of the jack pine in jeopardy.

The process for planning and implementing a successful release program can take up to one year to complete, and I have tried to outline here the 1984 program to give you an example of how that process evolves.

The first step took place in October of 1983 when the operations forester checked the assessment results and through ground checks determined the areas or plantations which required tending. These tending areas were then incorporated into the annual plan, which now is called the annual work schedule, and submitted to the Ministry of Natural Resources in

November of 1983.

At the time of submission the appropriate buffer zones were established using the Ministry of the Environment guidelines. Block C was one of the buffer zones and received no tending either in 1984 or 1986.

In April of 1984 the tending program was approved as part of the annual plan. In June of 1984 a form five, also known as an application to perform an extermination from an airborne machine, was submitted to the Ministry of the Environment.

Upon examination of the maps and the aerial photos with the Ministry of the Environment personnel the program was approved.

In July and August of 1984 the block boundaries and the buffer zones were marked on the ground and a final check was done to make sure nothing had changed drastically since the October submission. Public notices were also placed in the local papers at that time.

In September of 1984 the Ministry of the Environment was notified that the program was to commence, signs were placed at access points to the spray blocks and the project was completed.

The program in 1986 and the program today follow similar steps to the above, although the timing

may be somewhat different.

Q. If I could stop you there again just for a moment, Mr. Bunce. You indicated earlier that tending was done on this case study as reflected in the slides you have just gone through in both 1984 and 1986.

Did the silvicultural prescriptions for the case study area for this case study specifically contemplate the possibility of multiple tending treatments?

A. Yes. That is part of the silvicultural specifications and standards on this site type. It was a standard practice that tending would probably be necessary in the third year and possibly in the fifth year as well.

Q. Thank you.

A. The results of the tending program cannot be separated from the entire regeneration package, and Mr. Nicks in the renewal panel went through the growth and survival of the four individual blocks.

I have two slides, however, to show. The first one being slide No. 9.1 from the case study which is a picture of block C. The stocking at the fifth year in that area was 55 per cent of thin leafed,

non-vigorous jack pine. You can see how big the stem is.

In fact, I am sure that you will recall from last week that Mr. Nicks brought in an actual tree from this block, block C, as opposed to the next slide that I will show you which is slide No. 9.4 from the case study area.

I guess I should back up to make sure you are -- to give a little bit more detail on this one. The slide before, as was mentioned earlier, the residual trees were left, there was no tending in either 1984 or 1986 on that block as opposed to this block, block B, in which the residuals were removed at the time of site preparation.

There were new tending treatments carried out, the stocking at fifth year on this area was 81 per cent and as you can see there are very healthy, vigorously growing jack pine and, again, the stem brought in by Mr. Nicks was from this block as well and I believe that the difference in volume at that time was five times more for block B than from block C.

Q. Just dealing with this photograph, Mr. Bunce, what are the species evident in the photograph?

A. You are looking at jack pine in the

foreground. However, you can see some aspen in the background just sticking through. It's probably only about 10 to 20 aspen in there, the remainder is jack pine.

Q. Could you go back for a moment, please, to 9.1. And with respect to this photograph, you have indicated that this was block C which did not received tending treatments.

Are the conditions depicted in this photograph those that applied -- that would have applied had a ground application of herbicides been undertaken?

A. Well, this photo I believe was taken in the fall of 1989, so it probably has three years more growth than the most recent treatment done in 1986.

So although the aspen and jack pine may be somewhat smaller, the residuals would have been there and we would have had the same probably amount of competition, only it wouldn't have been as high.

As you can see from there, it would be very difficult for somebody with a ground skidder pulling a sprayer behind to try and maneuver a skidder on wheels to do an application in that area.

Q. Does that complete the slides that

you wish to show to the Board, Mr. Bunce?

A. Yes, that's all the slides that I have.

Q. Thank you. Thank you, Mr. Stanclik.

Mr. Bunce, I provided you over the luncheon break with a copy of exhibit -- a photocopy of Exhibit 1149 which, the Board may recall, is a photograph of two trees, a photographed introduced by Mr. Waddell and Mr. Nicks when they testified last week.

The evidence was that the -- I should ask you, Mr. Bunce. First of you, do you have a copy of that exhibit?

A. Yes, I have a copy.

Q. Who took that photograph?

A. I took that photograph.

Q. Can you confirm for the Board where the trees shown in the photograph came from?

A. Yes. I can confirm that the larger tree on the left was from block B and the smaller tree on the right was from block C.

Q. When did you take the photograph?

A. The photograph was taken, I do believe, in -- it was either last Friday or the Friday before, I'm sorry.

Q. That's fine. Where do you reside? What part of the province, Mr. Bunce?

A. I reside in Espanola, Ontario.

Q. And how long have you been practising forestry on the same limits, the same land area?

A. I have been in the same area for 11 years.

Q. For how many of those years have you been involved in tending activities?

A. I have been involved in the tending aspect I would say for 9 or 10 years.

Q. Do you have any direct experience in tending activities apart from those 9 or 10 years on the same limits?

A. I had some experience in tending when I was a technician. I worked for a company in northern Ontario for three years and I did have some involvement in tending at that time.

Q. Do you hold a professional forestry degree today?

A. Yes, do I.

Q. Thank you.

Mr. Smith, could we move next to you, sir, to deal with the case study for Abitibi-Price Inc. Lakehead Woodlands Division, that's case study 4C.

And could you outline for the Board, please, the characteristics of the case study blocks that you consider relevant to a discussion of the tending activities that were undertaken?

MR. SMITH: A. Yes, I can. Madam Chair, as earlier stated in case study 4C evidence presented by Malcolm F. Squires, the area in concern is situated in a a productive mixed wood site dominated by poplar with white spruce, black spruce and balsam fir as the primary conifers. These sites are diverse, herb and shrub rich stands usually on well drained upland mineral soils.

This is photo 2.2 from case study 4C and indicates the type of area characteristic of a cover prior to harvesting. The soils are generally fine textured and support the potential for a variety of vigorous grass, herbaceous shrub competition. Because of this competition, there has been a transition with each intervention, in this case harvesting, over the last 20 years away from conifers. The more aggressive hardwood and shrub species tends to dominate.

Aspen is a major problem because of its capabilities of producing fast growing root suckers which quickly overtake and surpass the slower growing conifers.

In 1980 the areas was classified as NSR 3 and was given high priority for site conversion based on its close proximity in Thunder Bay, it is 60 kilometres from Thunder Bay, and its recognized productivity.

A ground inspection of the area in the fall of 1981 by myself and two company foresters, operational foresters, one directly in charge of this area, indicated that the level of competition was very severe, that we would be faced with drastic measures based on some of our past experience in using heavy site preparation type equipment, in this case the Marden lowland chopper.

A point of interest, this particular piece of equipment was developed in and around the second world war as a method of creating land strips in jungles and in some respects replaced machete type equipment.

The silvicultural prescription was developed using -- and this was in line with the existing FMA groundrules, where we would apply one chemical treatment followed by two mechanical treatments. Chemical treatments seem to enhance mechanical site preparation from the view point of breaking and shearing vegetation.

Although the drum roller filled with water is roughly 12 tonnes, we found that it was ineffective on this type of green vegetation because it would simply bounce off, it wouldn't shear, it wouldn't crush.

Unfortunately, in 1982 the herbicide 2,4-D was the only chemical available for aerial application in forestry use. We recognized it had some limitation as being a selective herbicide and decided to undertake the procedure to benefit the planters in terms of access, productivity and safety at the expense of possibly creating a grass, raspberry competition problem once the plantation was established.

Selective herbicides opened up successional pathways for vegetation excluding the spectrum of control.

Q. What actually happened then with respect to just the site preparation for a moment? What was actually done?

A. We sprayed the area in 1982 with 2,4-D using a fixed-wing type aircraft and implemented the program and planning procedure similar in a lot of respects to E.B. Eddy's planning approach, as stated by Mr. Bunce.

We decided to spray from the air over

ground application equipment because we were faced with a certain urgency and time constraints, that in effect we had committed ourselves to planting "x" number of trees in 1983.

We recognized that aerial application technology would give us -- because there was a land strip in very close proximity to this particular area, we felt that we would produce 150 hectares per hour using aerial application technology as opposed to ground that we had used in other areas on our license and we felt that that productivity -- the difference in productivity justified using aerial application equipment over the ground. We --

Q. Can you -- I'm sorry, go ahead.

A. We also felt that local available ground application expertise was lacking and not available in Thunder Bay in that time period.

The operators were committed, there simply wasn't the type of machinery, men available to do that size of a project. There was a large amount of brush and residual trees on the site and in some respects we felt would create a uniformity -- application of uniformity problem by starting and stopping. The operator had very poor visibility and we felt this treatment would be dangerous.

Q. Can you show the Board what the existing competition in fact looked like on these sites before the spray with the photograph?

A. Okay. That picture adjacent to the road is actually one of the whiter areas in terms of the level of competition that we were dealing with. I spent the better part of six weeks traversing the area. It was very difficult to walk because it was a very, very dense area.

We expected the combination of one chemical and two mechanical site preparation treatments would produce the benefits of reducing initial brush and shrub leaf competition, and we felt that we would definitely see an increase effectiveness primarily with the Marden chopper for site preparation which indeed was the case, and we anticipated an improvement in planter access, conditions and production.

All three of those objectives were achieved and the plantation was established and the initial establishment assessment data showed one year after the plant that 95 per cent of the trees were still indeed alive and well established.

Q. Could you have done the same site preparation effort on these sites, Mr. Smith, by manual means?

A. Extremely difficult, if not totally inappropriate. I'm not saying that it wasn't possible, I'm saying that the productivity would have been so low that conceivably we would still be situated in that area today.

Although establishment survival was high, as if on cue heavy competition started encroaching on the site and one month after planting in 1983 we had heavy grass and raspberry competition as anticipated. That is outside of the case study area; however, it is an indication of the type of vegetative cover situated over top of our plantation.

Q. What photograph number is that, Mr. Smith?

A. That's photo 7.4.

Q. Thank you.

A. Potential for increased seedling damage and mortality existed. As anticipated, during the winter of 1983 and -4 heavy snow compressed the dead grass on top of the planted seedlings, breaking some and burying many into a blanket vegetation.

Photo 7.5 from the case study indicates the escape. I would estimate 75 per cent of the plantation had fallen in the winter of 1983/84. In fact, that block is probably better off in terms of

number of trees in the vicinity. It had made it through the grass where many of them were buried underneath the grass.

Q. Are you saying that the -- sorry. What proportion of the case study area are you saying reflected conditions depicted in this photograph, approximately?

A. I would say approximately 75 per cent.

Q. And that was one month after planting?

A. That was one month after planting. The management forester responsible for this particular area, the Wolf River area, proposed the area for tending in 1984 based on this his knowledge of the plantation and its condition.

We looked at a number of tending options. We looked at simply a do-nothing option, allow seedlings to compete with other vegetation and accept the results; we looked at cleaning the vegetation manually using sand picks, as described by Mr. Bunce, and possible clearing saws; we looked at moving into the area with ground application machinery, in this case a tank either pulled or mounted on a skidder; we looked at chemically tending the area on the ground

with back pump or sprayers and we looked at chemically tending the area with aerial application equipment.

Q. Could I ask you to stop there for a moment, Mr. Smith.

MS. CRONK: Madam Chair, this is a new overhead being referred to by Mr. Smith. I would like to tender it as the next exhibit, please. (handed)

MADAM CHAIR: That will be Exhibit 1161, entitled Tending Alternatives for Case Study C, Panel 8 -- Panel 7, rather.

---EXHIBIT NO. 1161: Hard copy of overhead entitled Tending Alternatives for Case Study C (Panel 7).

MS. CRONK: Madam Chair, what was the exhibit number for that, please?

MADAM CHAIR: 1161.

MS. CRONK: Q. Mr. Smith, were all of the alternatives set out in this exhibit considered, in the instance of this case study, as potential tending alternatives?

MR. SMITH: A. Yes, they were.

Q. And what option was in fact chosen as the tending option to be pursued?

A. Option E was the preferred option and the one that was accepted.

Q. Can you explain to the Board why that

was the case?

A. Option A, the no-tending option was unacceptable. We felt that because of the complexity of this treatment a tremendous amount of time and money had been spent establishing this plantation. As with all our plantations, we consider them an integral component of our long and short term wood supply for part of the company's fiber requirements.

Past experience in areas surrounding the case study block had indicated that plantations left in this particular state would indeed fail by year three.

Q. What about option No. 2?

A. Option No. 2, the hand brushing, on this particular site - and we have done some hand work in the division - we considered it impractical. We felt that it may indeed increase the level of competition.

We found that with the particular species that we were dealing with the severe competition problems were in the common grass, blue joint grass category and raspberry, that hand brushing was, in effect -- this type of competition would simply grow back and we felt that we would probably require up to four years of continuous treating for different seasons. We felt that cost would be totally

prohibited.

Q. What about the application of herbicides by use of ground application machinery, why was that option not selected?

A. That options was rejected as seedlings would be invisible on the grass and in raspberries with this type of equipment. The operators suspended a mid-sized skidder, very difficult to see, very difficult to maneuver around the seedlings. We felt that we would probably crush more seedlings than we would release.

Option D, the chemical tending with backpack sprayers, this treatment was rejected because the height and density of competing vegetation restricted walking and the ability to spray the trees.

We took the human exposure condition into effect. We were concerned because the density of the competition, in this case grass, was at least a metre tall. There would be a lot of this particular chemical reflecting off the grass and on to the applicators in the field.

We decided in the end to go with option E. This was the preferred option chosen because of ease of operation, more uniform application, less occupational exposure and a lower cost alternative and

we also expected that we would only need one release type treatment.

Q. What chemical was used?

A. Okay. The herbicide glyphosate, the label name at that time was Roundup and today referred to as Vision, was chosen over our other alternative 2,4-D simply because of its superior chemical properties in controlling grass and raspberry.

Q. Is 2,4-D effective against blue joint grass?

A. Definitely not.

Q. What about raspberry?

A. Definitely not.

Q. Was raspberry competition present on the site?

A. Raspberry competition was present on the site.

Q. And when were the spray operations actually carried out?

A. In 1984 the area was sprayed using a fixed-wing aircraft supplied by General Airspray of Lucan, Ontario, an application company that has been in existence in Ontario for 30 years.

Mixing and loading was contracted to Canadian Forestry Consultants of Thunder Bay and the

company supplied three licensed representatives that assumed total control over the projection: safety, ensuring the integrity of the buffer zones, and we had an aircraft on site, a company leased helicopter whose primary function was a safety function.

Q. How many of the blocks were sprayed in 1984?

A. Blocks 5 and 6 were sprayed in 1984. In 1984 we had classified block 10 as a no-spray. In this particular case it was more of a deferral than a cancellation of a spray program. We simply decided to see what was going to happen in terms of level of competition continuing to develop and creating a greater problem for the trees.

In 1985 spray operations were conducted in a similar manner to that of the application in 1984 with a few variations. We were using and had leased and tendered four helicopters and the contractor that supplied the helicopters also supplied the mixing and loading equipment.

Q. And what block or blocks were sprayed in 1985?

A. Block 10 was sprayed in 1985.

Q. Was glyphosate used on all three blocks?

A. Yes, it was.

Q. Okay. What were the results associated with the tending effort?

A. If I could turn the projector back on.
This is an overview of the plantation.

Q. I think the Board has seen this photograph before in a different context, Mr. Smith. what number is it? Can you help me with that?

A. It's photo 7.17.

Q. What do you regard, if anything, as being significant about the conditions depicted in this photograph?

A. The major competitors for light, water and nutrients were satisfactorily suppressed allowing the crop trees to survive and take full advantage of the resources.

I think it was successful based on the fact that the seedlings were, when sprayed, in a very early developmental stage on a productive site. And referring that to evidence presented by Dr. McCormack indicating that the gain is felt, a significant gain is felt particularly on productive sites if you can tend early, and that's what happened in this particular case.

We were essentially right behind the planting program. As you can see from the slide, and this is representative of what exists out there today, the plantation is well established, the trees are approaching -- I would think in 1990 would be at the free to grow stage.

I would like to add in closing that because this was a delicate operation, very complex in terms of timing in a series of silvicultural events, that we spent a maximum amount of time walking through this area and looking at it. And since I was involved with the initial field surveys in 1981, the majority of species that were present in 1981 exist in 1990; in other words, they were temporarily suppressed, but they are starting to come back on the site.

The conifers are definitely in a more competitive position than they were seven or eight years ago.

Q. In your opinion, Mr. Smith, could the results described in the case study with respect to the conifers have been realized had chemical tending not been undertaken?

A. In this particular instance, no.

Q. I didn't hear you, I'm sorry?

A. No. Without the chemical release

program that was undertaken, the plantation definitely would not be in this state today.

Q. Thank you.

MS. CRONK: Mr. Stanclik, could you put the lights up again. Thanks very much.

Q. Mr. Smith, where do you reside, sir?

MR. SMITH: A. Thunder Bay, Ontario.

Q. And how long have you practised forestry on the same land base, the same limits?

A. Ten years.

Q. For how many of those years have you been involved in tending activities?

A. For the full 10 years.

Q. Thank you. Mr. Ferguson, could we turn to you next, please. And the Board may recall from earlier this week your evidence relates to case study 4A, being the case study by Canadian Pacific dealing with the jack pine upland cover type.

Again, could you focus on tending and explain to the Board how many blocks were involved and then the circumstances that you considered relevant to what was done with respect to tending?

MR. FERGUSON: A. Certainly. Madam Chair, Mr. Martel, I am sure you are quite familiar with the location of the jack pine upland cover type

location by now.

MS. CRONK: I am going to confess, Mr. Martel and Madam Chair, I said they know where these are, don't tell the Board again where the locations of these case studies are, so that's why you are hearing it from the four of them quite this way.

I hope that's the case because that's the direction they received.

MR. FERGUSON: Suffice it to say it is located in the English River Forest and is representative of the jack pine upland cover type.

As the Board may recall, renewal of the Canadian Pacific case study took place in 1982 through site preparation with the Bracke scarifier accompanied with simultaneous seeding. There were a number of tending options available for the Canadian Pacific case study and maybe I can just illustrate those by way of an overhead.

MS. CRONK: Madam Chair, Mr. Martel, copies of the overheads that Mr. Ferguson will be referring to are Exhibit 1132. They are part of Exhibit 1132, it is a letter dated April 25th. It's the one containing overheads of a number of these witnesses.

It is toward the back of Exhibit 1132

immediately before the table, Table 1, and following to which Mr. Stanclik referred.

MR. FERGUSON: Basically these are the same options which Mr. Smith has just described, so I won't go into any detail.

There were five options available basically and those options being, No. 1, aerial spray with herbicide; No. 2, ground spray with herbicide; No. 3, manual release with herbicide; No. 4, manual release without herbicide; and, No. 5, no treatment.

This case study is in fact an illustration that a tending treatment is not necessary in all cases. No. 5, the no-treatment option was selected in this particular case study.

MS. CRONK: Q. Can you explain to the Board why it was felt that no tending treatment was necessary?

MR. FERGUSON: A. Certainly. Following the renewal of this case study area, the area was checked periodically following renewal. I have results of a stocking survey which was conducted two years after renewal took place in 1984 and also results of the formal fifth-year stocking survey as required by the FMA.

Again, if I may illustrate it by way of

overhead. In the second year following renewal the stocking to conifer primarily was jack pine at 32 per cent and 2 per cent stocking to black spruce for a combined stocking of 34 per cent.

As well, there was a poplar component of 11 per cent stocking; however, the poplar at that time was not suppressing the conifer in any way, as well there was slight competition from grasses, raspberries and other shrubery, however they are not considered a problem at that time.

No tending was required or prescribed, although the area was flagged as a potential problem area in that the species which could develop into competition problems were present on the site. For that reason the case study area was watched over the next few years until the formal fifth-year stocking assessment, as required by the FMA, was conducted.

At that time, this being 1987 now, the jack pine component on the site had increased to a stocking level of 45 per cent, black spruce had increased to 7 per cent for a combined conifer stocking of 50 per cent, meeting the minimum requirements of the FMA, as well the poplar stocking had increased from 11 to 28 per cent.

However, again, despite the increase in

poplar stocking it is still not considered a competition problem in that, generally speaking, poplar is not in a dominant position, was not occupying the same sites as the conifer species and was not impeding conifer growth.

Similarly, the grasses and the raspberry, a little bit of pin cherry was on the site, was still not suppressing conifer growth, still not quite free of the potential for suppression but not a problem in 1987, therefore, no tending was prescribed.

A subsequent survey conducted in 1989 indicated that the conifer stocking had again increased slightly up to, I believe, 54 per cent, the poplar stocking had leveled off, was not increasing, again not suppressing conifer growth in any way. We feel now that this is through the crucial stage and the free to grow assessement has been requested from the Ministry.

Q. Do you anticipate, Mr. Ferguson, that any tending of this area will be required?

A. I don't believe so. I think it's to the free to grow standard and should continue unimpeded in the future.

Q. And can you illustrate for the Board what the current conditions are on the site?

A. Yes, I believe I have two slides

which show the condition of this stand.

This is photo 9.3 from the Canadian Pacific case study showing the mix of species on the stand, primarily jack pine throughout, growing well, good leader growth. These photos were taken in June of 1989 and they were growing well at that time. A component of poplar scattered throughout the stand, but not impeding the conifer growth.

Can I have the next slide, please.

Again, a very similar situation. The jack pine, good leader growth in the spring of 1989, a component of aspen in the stand.

Q. Sorry, you were pointing -- with respect to the aspen component you were pointing to the middle of the photograph?

A. Right, to the centre of photo. Some lesser vegetation on the forest floor, but generally speaking the conifer is growing unimpeded and we do not foresee a problem developing at this point in time.

Q. And what photograph number is that, Mr. Ferguson?

A. That's 9.5, again from the Canadian Pacific case study 4A.

Q. Thank you.

MS. CRONK: Mr. Stanclik, could we have

the light back on, please. Thank you.

Q. Mr. Ferguson, where do you currently reside?

MR. FERGUSON: A. I live in the Town of Dryden.

Q. The Board has heard in your previous evidence about your experience with renewal activities dealing just with tending. How long have you been involved in tending activities on the same limits?

A. I have been involved with tending activities since 1980, that being 10 years at this point in time.

Q. Could you remind me, sir, as to how long you have been practising forestry in total?

A. I have been practising forestry on the English River Forest since 1974.

Q. Mr. Ferguson, I would like to refer you as well to an interrogatory delivered by Forests for Tomorrow with respect to Panel No. 4. It is part of Exhibit 1103 and it's interrogatory No. 5.

MS. CRONK: If I could have the indulgence of the Board to find it.

It is part, Madam Chair, of Exhibit 1103 and it was an inquiry from Forests for Tomorrow of the case study overview panel inquiring as to how many

year's experience the forester referred to in case study 4A had of the silvicultural prescriptions and their results for the area in the case study.

Q. Mr. Ferguson, who is the forester referred to in the response?

MR. FERGUSON: A. The forester in the response is myself.

Q. And does the response accurately set out your experience relative to the case study area?

A. Yes, it does.

Q. Thank you very much.

Mr. Stanclik, may we come to you, sir, and could I ask you with respect to case study 4D, the Abitibi-Price Inc. Iroquois Falls study, to, again with the particular perspective of tending in mind, outline for the Board what was involved in the tending activities on that case study area?

MR. STANCLIK: A. Yes, I will. The Iroquois Falls Forest case study is located two miles north of Camp 33. It is composed of three blocks, block A which is the yellow, block B and block C, each of which have different site characteristics, although B and C are similar, each of which has received different silvicultural treatments. All three were prescribed to be regenerated to black spruce.

Block A which is, I am told, 67 hectares in size was originally upland mixed wood stand on a rich, fine textured clay soil type, a combination of fine soil texture and moisture regime present on the site, good drainage and depth of soil provide a rich growing environment for most vegetative species on the site.

Of the three sites, this one has the greatest potential for growth of the selected crop trees, as well as a competitor species and in particular raspberry, grass, poplar and birch.

Block B, which is 60 hectares in size, is down sloped from A and is a lowland black spruce site characterized by a nutrient rich peat over fine clay soils. Water movement though the peat transports nutrients to a variety of vegetation and species on the site and promotes the growth of competitive species, although block B is not as rich a site as block A. The competition species on block B were primarily alder with some birch and grasses.

Block C is 139 hectares in size. It's a lowland black spruce site similar to block B and is characterized by deeper peat, poorer in nutrient availability. The primary competitive species is alder. All of the case study is composed of 266

hectares.

Four tending alternatives have been considered in the Iroquois Falls Forest. These are no tending, aerial tending, ground chemical spray, manual tending with or without chemical release.

Q. Mr. Stanclik, could I interrupt you there, please.

MS. CRONK: The overhead to which Mr. Stanclik is referring is new, Madam Chair, and I tender that as the next exhibit, please. (handed)

MADAM CHAIR: Thank you. That will be Exhibit 1162.

---EXHIBIT NO. 1162: Hard copy of overhead entitled Tending Options.

MS. CRONK: Q. Sorry, Mr. Stanclik. Thank you. Were each and all of those options considered with respect to the three blocks forming this case study area?

MR. STANCLIK: A. Yes, all four were considered and one and two were actually used; no tending and aerial tending.

Q. Could you elaborate on that?

A. In the case of block A, it was determined that in 1982 the tending treatment was required for the benefit of the block; however, the

availability of glyphosate was foreseen in the future and it was decided that a more effective treatment could be achieved using glyphosate rather than 2,4-D. This site had raspberries, grass, birch and poplar on it.

The ground spray alternative using a mechanized mobile carrier had been tested in Iroquois Falls Forest and had proved to be impractical since it was impossible to maintain uniform spray coverage because of the irregularity in terrain, and it was impossible to avoid mechanical damage to the crop trees.

The manual tending with or without chemical release alternative was also found to use more chemical per unit area treated than other treatments and had a potentially higher occupational exposure of the applicators to the chemical. Also, this method had low productivity resulting in extremely high costs.

The manual tending portion of that, the -- was not used because of safety concerns, but the productivity and efficacy related specifically to brush saw use.

Q. What then was the option used on all of the blocks?

A. As mentioned earlier, the aerial

tending alternative was employed on all three blocks. In our silvicultural program, aerial tending is the recommended method where tending is required since it is the most effective, most efficient in terms of manpower and chemical use, has the highest degree of worker safety, is easiest to control and also the most economical. Planning and implementation of the aerial spray program was similar to what was described by Mr. Bunce.

This overhead is of the treatments, the study blocks you see. It is Table 1 on page 29 of the black spruce Clay Belt management case study in Panel 4. Block A was harvested in 1978, received site preparation in the winter of 1980 and subsequently planting to container stock in the spring of '80 and received glyphosate treatment in 1984.

Block B was harvested in the winter of '79, was left for natural regeneration using group seed trees, was tended at the same time as block A as it was intermixed with block A.

Block C was harvested in two stages. The first cut came in 1979; the second cut, the alternate blocks, was in 1986 and received a tending application of 2,4-D in 1988.

All three blocks had 60 metre no-spray

screen buffers established along the two streams adjacent to the blocks. Plantation survival and growth assessment was carried out in the fall of the year of planting and in the first, second and fifth years after spray -- pardon me, after planting. This was the first, second and fifth year after planting.

In addition, a fifth-year stocking assessment was carried out. At these times, the decision on whether to tend or not to tend is made. If tending is required or will be required, timing will also be determined. Tending may take place from one to six years after planting.

In the case of block A, the second year survival and growth assessment done in 1982 revealed the plantation would benefit from a tending treatment; however, glyphosate was due to come on to the market within a year or two and it was decided that a better result could be obtained using glyphosate instead of 2,4-D because of the competitor species on the site.

In the case of the other two blocks, which are natural regeneration, usually in natural regenerated areas the decision to tend or not to tend is made after the review of the fifth-year stocking assessment survey data which also includes an assessment of the competition type and degree.

In case of block B, however, since it was mixed in with block A, it was actually assessed at the same time as block A was.

Block C received a stocking assessment of the first cut in 1987 at which time it was determined that an application of 2,4-D was required and, as previously mentioned, was carried out in 1988. Each of the three blocks received one application of herbicide.

The last overhead is of the assessment data collected from the three blocks. There is a summary in Appendix 2 on page 50 for the black spruce Clay Belt management case study in Panel 4.

The fifth-year survival percentage for the plantation was 91 per cent, stocking at the fifth year for blocks A, B and C were 65, 51 and 54 per cent respectively. All three blocks exceeded the minimum stocking requirement of 40 per as identified in Appendix 1 on page 47 and 48 of the case study, also known as the groundrules.

Q. Once again, can you illustrate for the Board what the current conditions look like?

I'm sorry, go ahead.

A. Both blocks A and B have been submitted for free to grow. Block C is free of competition but requires additional height in the areas

that were cut in 1986 before it can be submitted for free to grow.

Now, to conclude I would like to show five slides. The first slide is photo No. 9.3 in the case study. This is a ground shot of the tended plantation. You will see the individual well spaced crop trees.

Q. What block is this, Mr. Stanclik?

A. This is block A.

Q. Thank you.

A. Also you will note that there is complete ground cover. This was taken in September of '89. There were a variety of grasses and mosses present. In addition, throughout the plantation there are aspen/poplar, balsam/poplar, birch, willow, dogwood and alder present. This is five years after the tending treatment. The next one.

This is block B. This slide is No. 9.4 in the case study. The ground shot of the advanced regeneration in block B. You can see the remnants here of the alder that was present at the time of the spray in 1984. (indicating)

Q. Sorry, when you said here where were you pointing, Mr. Stanclik?

A. Behind the advanced regeneration,

approximately in the middle foreground.

Q. How many years after tending was this photo taken?

A. This is also five years after tending and again you can see there is complete ground cover. This is weed in here, there is some grasses and sedges.

Similarly here there is poplar, birch, alder and other wooden species present on the site five years after tending.

The next slide. This is block C, photo No. 9.5 in the case study. It is a ground shot of the first cut which took place in 1979. This is nine years after harvest and this is a typical lowland vegetation map with mosses here in the very front, a little bit further back along the trees are weeds, you can see the remnants of the alder behind the advanced regeneration. The alder was present at the time of the spray in 1988.

The next slide, please.

Q. Sorry. Before you leave the last one, how many years after tending was that photograph taken?

A. This is one year after tending.

Q. Thank you.

A. The next slide is photo No. 9.8 in the case study. It is an aerial shot. It's an aerial

shot of the plantation in block A, in this part here. (indicated)

Q. You are pointing where, for the record, Mr. Stanclik?

A. The top left and the bottom of the photo. In the centre and top right is a piece of block B. You can see there is -- you can see the rows of crop trees, you can also see that there is ground cover between the trees identified by the green.

Q. And how many years after the release treatments was this photograph taken?

A. This is five year after release treatment.

And the last slide. This is block A in the foreground, block B to the upper right and block C in the background.

As far as the ground cover is concerned, in those three boxes 99.9 per cent of the ground has vegetative or organic matter over top of the subsoil. Again, note the abundance of crop trees and lesser vegetation between the rows of crop trees.

Q. I am just looking at the background in that photograph, Mr. Stanclik, and it appears to me to have been left uncut; is that correct?

A. Yes, some areas were unmerchantable

and they were left. They were either muskeg or protection forest or a very poor quality in the site class tree type of stand and was not merchantable at that time.

Q. And how many years after the release treatment was this photograph taken?

A. In the foreground, this is five years after release. In the background, the release was done in 1988, so this was one year after release. It is quite green back there.

Q. Thank you. Now, at my request, Mr. Stanclik, have you brought for illustration purposes for the Board's review a sample of what some of the trees look like on the tended and untended areas of this case study?

A. Yes, I have. You must understood that black spruce does not grow nearly as quickly as jack pine. These are the bottom of two trees from the plantation, both were paper pots, both were planted at the same time.

The smaller diameter one is from an area of block A that was not sprayed and the larger diameter stem is from block A immediately adjacent to the unsprayed area. Now, these are representative of average trees based on the data that was collected and

appears in one of Dr. McCormack's tables. Right now I forget which one it is.

Q. Perhaps we will come back to that. Could you just identify again for the record, please, you are holding two stem segments in your hand?

A. Yes.

Q. The one --

A. The root collar is right about where the larger end is cut. This is the very bottom of each tree.

Q. And the stem segment which is narrower in diameter is from block A did you say?

A. They are both from block A.

Q. Yes.

A. But the smaller diameter stem is from an unsprayed portion of block A and the large diameter one is from an area immediately adjacent to the location of the unsprayed stem. Both --

Q. And can -- sorry, go ahead.

A. This one received a tending treatment in 1984 with glyphosate, this one did not receive any tending treatment. (indicating)

Q. Can you offer any observations on the relative diameters of those two stand segments for the Board?

A. The smaller stem has a diameter of 1.9 centimetres, the larger stem has a diameter of 2.7 centimetres and the volume of the larger stem is roughly double that of the smaller stem.

Q. Again, the smaller stem being from the unsprayed area?

A. The unsprayed area. In addition, at the time of collection I collected branches and needles from these two trees and the branches from the unsprayed tree are very fine, the annual increment -- annual growth is very short, the needles are very small indicating poor vigor; whereas the branches from the sprayed tree, very long annual growth segments, are thicker in diameter and have much larger needles, and in fact there was even a cone present on this particular tree indicating much more vigor.

Q. The first ones that you described are from the sprayed or unsprayed area?

A. The first were from the unsprayed tree.

Q. Could you pass those up for the Board, please, Mr. Stanclik.

MS. CRONK: Madam Chair, could I ask first that the two stem segments be marked in combination as the next exhibit.

MADAM CHAIR: That will be Exhibit 1163.

MS. CRONK: These are the stem segments from block A of case study 4D.

MADAM CHAIR: 4D?

MS. CRONK: (nodding affirmatively)

---EXHIBIT NO. 1163: Two stem segments taken from block A of case study 4D.

MS. CRONK: Could I ask, Madam Chair, that the branch -- what would I call that, Mr. Stanclik, the cutting of the branches of the trees from block A?

MR. STANSLIK: Sure.

MS. CRONK: Treated and untreated be marked as the next exhibit, perhaps A and B. And if you agree I will ask Mr. Stanclik to label which was treated and which one was not treated.

MADAM CHAIR: The treated one will be 1164A.

MS. CRONK: Thank you.

MADAM CHAIR: And the untreated sample will be 1164B.

---EXHIBIT NO. 1164A: Sample of a treated branch taken from block A of case study 4D.

---EXHIBIT NO. 1164B: Sample of an untreated branch taken from block A of case study 4D.

MS. CRONK: Thank you. Perhaps what we could do at the break with those, Madam Chair, is to tie them together and have them -- I think the record is clear as to which is which, so perhaps we just tie them together and tag them as Exhibit 1163.

Would that be satisfactory?

MADAM CHAIR: Yes, that's fine. Thank you.

MS. CRONK: Thank you.

Q. Mr. Stanclik, with respect to the two branch parts, if I can describe it that way, did they come from same trees or different trees than did the stem segments?

MR. STANCLIK: A. They came from the same trees.

Q. Thank you. And who took the samples, both the stem segments and the branch segments?

A. I did.

Q. And when did you do so?

A. Friday before we were supposed to present evidence in Thunder Bay.

MR. FREIDIN: Which Friday was that?

MS. CRONK: Q. I won't ask you when you replaced the water in the bags with the branch segments, but you took the -- you physically obtained

those exhibits?

MR. STANCLIK: A. Yes, I did.

Q. Thank you very much. Mr. Stanclik, where do you personally reside?

A. I reside in Iroquois Falls.

Q. And how long have you practised forestry on the same limits?

A. I have practised forest management in the Iroquois Falls Forest since its inception in 1980.

Q. And I understand that in my summary introductory remarks to the Board when this panel began its evidence I made an error concerning your professional and business background; is that correct?

A. That's correct.

Q. I am showing you the transcript from transcript Volume 196, I think it's page 34,742, the middle paragraph, and could you identify for the Board, please, the error that I made and correct it?

A. The statement reads:

"He is currently employed by Abitibi-Price Inc. Iroquois Falls, again, as management forester for the Iroquois Falls Forest, the position he has held for the last five years."

In fact it has been 11 years.

Q. And you have indicated that you have worked the last 10 years on the Iroquois Falls Forest.

Prior to that, were you involved in the practice of forestry in the Province of Ontario?

A. Yes, I was with Abitibi-Price in another district in Iroquois Falls division since 1974.

Q. Thank you very much.

Dr. McCormack, I propose to return to you, sir.

MS. CRONK: Madam Chair, I am going to return now to Dr. McCormack for a portion of his evidence. Does the Board wish to rise as its normal time or would now be convenient?

MADAM CHAIR: Which is better for Dr. McCormack? We can have our 20-minute break now or we can take it in 10 minutes.

MS. CRONK: If it is acceptable to the Board I would prefer to do it now.

MADAM CHAIR: That's fine.

MS. CRONK: Thank you.

MADAM CHAIR: We will be back at 20 after three.

MS. CRONK: Thank you.

---Recess at 3:00 p.m.

---On resuming at 3:25 p.m.:

MADAM CHAIR: Please be seated.

MS. CRONK: Q. Dr. McCormack, I would like to turn now to the subject of the appropriateness or inappropriateness of the use of herbicides in timber management.

Can you tell me first, are there means by which in your view and in the view of the Industry the appropriateness of the use of herbicides by timber managers can be measured?

DR. McCORMACK: A. Yes, there are several things to be considered.

Madam Chair, Mr. Martel, we are now at page 115 of our statement of evidence and I will pick up where I left off, following in sequence the information that is in the statement of evidence, and in more detail than I have here on page 115 is a summary of considerations when one addresses the appropriateness of use of the herbicides.

Just to summarize that, when we consider the use of herbicides we would look at efficacy in terms of the effectiveness of the herbicide as far as growth response and benefit, health, vigor, robustness, if you will, of the desirable vegetation and the levels of effect on the undesirable vegetation.

Secondly is described a category of

environmental impacts. I think I might prefer to refer to this as environmental interactions with the ecosystem when the treatments are applied and that certainly must be considered as we consider the ecosystem as a whole. And then because we are addressing the timber productivity and structure which is based on economics, of course, we have to look at the economic benefits that are involved.

So we will address and I will directly deal with these, but it will take some time to work through these items.

Continuing with the information that's summarized at page 115, at this point we start to deal with this basic question which is before you: Do herbicides work, does this technology really perform in the best interest of timber production and in the best interest of the forest so that we consider the benefits, the forest conditions and responses which result from the use of herbicides.

Now, especially within an operational framework there are three levels that need to be considered in appraising the results of a herbicide treatment. These can be separated out, especially the first two because they have distinct characteristicss of their own.

The first is what I refer to as delivery effectiveness. It is not so much the chemical working, but if we are using a herbicide which is known to work we first have to consider if we have applied it properly and that's what I am referring to here in the way of delivery. It must be properly distributed across the target and that's the first step in evaluating.

If something comes up and the applicator was unsuccessful in carrying out a proper delivery or that which was intended in covering the target and delivering the proper amount and so forth, then it is not very realistic to evaluate the efficacy as such unless it was properly administered.

The next step, though, does deal with efficacy. Assuming that this treatment has been delivered in the way intended, the first step is to look at the efficacy of the prescription and in the early stages this is usually an assessment of the level of suppression of the target vegetation since that's the easiest thing to observe and that is the first effect which is evident on the site. That usually can be carried out in the first year or two, sometimes it takes a little longer depending on the nature of the treatment.

Then the third level, and in terms of practice, the most important one is what happens with the crop trees as far as stocking and growth responses because that's really what we are dealing with here.

Sometimes people looking at the literature become preoccupied with how much brush did we suppress, how much undesirable vegetation have we reduced. The real bottom line is item No. 3, how successful have we been in achieving the stocking levels necessary for management to be carried out and how successful have we been in achieving positive growth responses of the crop trees. That's really what matters almost regardless of the condition of the vegetation.

As has been pointed out in our statement of evidence, especially relative to long term growth responses and yield responses in the forest, there are some other considerations here because, as has been pointed out and also as summarized in our statement of evidence, we don't have as many hard numbers as we should have to reflect the responses from herbicide treatments.

When one considers that these treatments go back over 40 years, one figures we should be able to come up with all kinds of numbers and there are some

reasons for this and those are summarized, but I would like to point them out before we get into some of the specifics of evaluating whether or not herbicides really do work.

One is the technology developments. This has been a very dynamic technology over the years, chemistries have changed, as we have observed good results we have put more effort into things like delivery technology, configuration of spray booms, nozzles, nozzle tips, all the things that make up a herbicide treatment have developed tremendously over the last 15 to 20 years and some of the newer chemistries actually give us much greater capability and selectivity in carrying out treatments; thus, it's difficult to take treatments from, say, 20, 30 or even 40 years ago and compare those with the capability we have today. So that's problem No. 1.

Because of the enthusiasm over the efficacy of these treatments we over the years have ended up doing more studies in the way of retrospective studies with limited data where we say: Wow, this looks so great, we better start to gather some data. We are not set up with the idea of gathering data in the first place because some of the positive results were so apparent when the treatments were being carried

out.

Another deterrent in collecting large amounts of information relate to the variability across and in-between sites, that these different site conditions, as I think has been illustrated in the case studies, have had different responses. We see different responses I think which is also evident, say, between responses of spruce trees as compared to responses of jack pine trees, also restrict our ability to put growth in yield data out in a consumable form on a broad scale.

Another factor is that we have over the years failed to adequately document the stand establishment or plantation establishment gains, and by this I mean the benefit where we end up with adequate stocking, a stand which is quite manageable versus a developing stand which is inadequately stocked to justify management, that a treatment provides a manageable stand versus an untreated area not having a manageable stand and that, in fact, in the early stages is not a growth response. We get the manageable stand, we deal with it and the fact that we gained is sufficient or has been sufficient to satisfy the manager.

In the real world of carrying out

research, often studies are developed within what can be termed short term research time frames. The mobility of the scientists, the desire for advancement, the pressure on a young scientist to publish unfortunately forces them into dealing with two, three, four year studies so that they can publish, they can make their career advancements. Then if they do advance they get transferred to another region, they get promoted and within our research structure there has been inadequate discipline and direction to assure that some of these studies are carried out over a longer period of time.

Consequently, we get publications of two, three, four, five year results and then the study gets lost in the shuffle of changing personnel and that has been a problem across North America.

Q. Is that a problem unique, Dr. McCormack, to research in forestry?

A. I think it is characteristic of a great deal of forestry research today where we are dealing with long term dimensions, relatively long term in a scientist's career, 10, 15, perhaps 20 years to fully measure the results of a treatment and it is unlikely that a forester, that person being manager or a research scientist, is going to remain with that

project or that specific location for those periods of time.

Even in university faculties today there is much more mobility so that studies get lost in this mobility shuffle and that has been a direct influence in the lack of long term studies being published.

Q. You have outlined all of these considerations as being relevant to compiling and appraising growth and yield responses, what do you mean by growth and yield in the context of the evidence you have just given?

A. Okay. Well, the two terms go hand in and but there are differences. Yield, in many respects, is an accumulation of growth over time, but when forest managers or timber managers speak of yield they're usually expressing this in terms of usable volume; that which could be harvested with some purpose. When we talk about growth we are really talking about the speed at which these trees develop and grow to reach a merchantable level that can be considered yield.

So growth we can observe immediately, but if these are young trees we can measure volumes and compare them, but it takes a while before you get to a realistic level of evaluating yield. So it is the

yield part that is most subject to the problems of long term studies.

Q. Are there in your view -- I'm sorry, is there in your view a difference as among herbicides regarding their ability to control competition?

A. There are differences and I am prepared to illustrate those. I would like to add just one comment to this growth response situation because recognizing this over the past two to three years I have spent considerable time calling and visiting operational people saying: What do you have for growth response data because we haven't collected enough, and almost to a manager the response has been: What do you need those numbers for, all you have to do is go out there and look at the trees. The response is so dramatic and so evident I am not going to waste my time measuring it.

I think that's just another consideration here when we address the lack of hard numbers. Not to say we don't have hard numbers, because I am prepared to show that there are.

Now, Ms. Cronk, in direct response to your question, I would like to move on and refer to Figure 1 in our statement of evidence which is on page 120. This would also be transparency 28 in the listing

of transparencies, but it is a figure that fills most of page 120 and in this figure I have characterized in a general way four herbicides across five types of vegetation.

On the vertical axis I show relative level of suppression by each of the four herbicides and then, as you can see, some distinctly different types of vegetation and this is kind of a mechanical portrayal of this relationship, but I tried to pick some characteristic types of vegetation which have differences as we must address them in managing them as competing vegetation.

Grasses which are monocots, they have a much different character from the other vegetation; raspberry which does not grow up as a woody shrub but is certainly a prolific species that occurs on disturbed areas following harvesting across the area of the undertaking, and actually is kind of the universal weed as we look at weed management problems in forestry. The same species extends across a wide area, it is a vigorous competitor.

Soft maples is another group, meaning such species as red maple or mountain maple. There are actually three or four of the maples that go into this group that we call soft maples, not to include sugar

maple. Birches, for the most part this would be white birch or paper birch, not to include yellow birch and aspen being the common trembling aspen.

Q. Dr. McCormack, could I just stop you there with respect to what you have just outlined over the next last few minutes. First, you referred to some type of grasses as monocots. Did I hear you correctly? What is that, please?

A. Monocots are the parallel vein, one seed leaf that is a taxonomical breakdown within plants but they are distinctively different in their structure, in the way they grow from dicots which are typified by other species mentioned here. They carry out their growth process in a slightly different way; thus, they must be handled differently when we go to manage them.

Q. You referred also during the course of your evidence to weed management and we see that term or a similar one in your curriculum vitae in a number of places by references to the Weed Science Society of America and to various weed management groups.

What do you mean when you use those terms?

A. It's almost unfortunate that these

societies have chosen within themselves as such. Weed science is actually a high science within the plant science professions. There are a series of regional groups and then there is a Weed Science Society of America which incorporates Canadian membership as well.

These are groups of scientists who deal with all levels of vegetation that in any kind of a situation can be classified as a weed. It may be a weed in one case, it may be a crop in another, but wherever it occurs as a weed these scientific -- these communities of scientists deal with them from such levels of science as looking at: How chemically do we block electron transfer in the photosynthetic process.

So you have a physiologist, you have a soil scientist, you have ecologists and so forth who deal with this. The term weed comes from its use with these societies, that it is a plant that is out of place and interfering with some purpose where a crop or a plant condition would be serving society.

Q. In what context is it then that you refer to the species on Figure 1 delineated on the bottom across the horizontal axis as being weeds?

A. Well, these would be competing vegetation in the forest regeneration condition; thus, they are competitors, they are interfering with the

manager's objective and in this case can be termed weed.

Q. Is that always the case or does it vary from area to area?

A. Well, it's a fairly common term. Whether or not these are weeds will vary from case to case. On your front lawn, for example, grasses would form desirable turf and you will be doing whatever you need to produce those and if you were growing raspberry fruits, obviously that would be the crop, or if you were growing any of these.

It is a matter of the kind of thing I pointed out earlier, the objective of the manager and then what you do to achieve that objective in producing the crop, and when it's undesirable and it interferes with the crop production we term it a weed.

Q. And in the context of the issue of the ability of various herbicides to control a competitor species, what does this figure indicate?

A. Well, I showed here the variety of spectra of control of these weeds by four different herbicides. This lower one highlighted in red is labelled 2,4-D. This is the 2,4-D herbicide which is one that is available for aerial application in the area of the undertaking that has been used for many,

many years and it is characterized by this red highlighted curve. It does not control grasses at all.

The implication there is, if you want to maintain grass cover 2,4-D is very usable because you can maintain grass cover, but at the same time it is not effective in suppressing raspberry, still very low as far as soft maple is concerned, but if you have birch you start to reach a level of silviculturally effective suppression, and if you have aspen the level of suppression is high enough that it is very realistic in terms of silvicultural effectiveness to use use 2,4-D. So you see there is a range across these species groups.

If I take hexazinone, which is this dashed lined highlighted with purple, this is the product Velpar which is registered for ground application at the present time. The manufacturer is pursuing aerial application for use in the area of the undertaking. You see that Velpar or hexazinone is quite effective on grasses, still fairly effective on raspberry and I will illustrate this with some of my slides.

If you have soft maple on the site, you actually have the capability of maintaining the soft maple cover because the low level of effectiveness.

So in comparison you can control grasses, you can control raspberries but it is unrealistic to look for any silviculturally effective level of control of soft maple with hexazinone. Similarly, depending on how much is applied, low level control of birch, but fairly good if you need to control aspen, level of suppression of aspen.

Now, the most frequently used herbicide at the present time in the area of the undertaking, Vision, has the active ingredient glyphosate which is illustrated by the heavy dark line. You see here that it is quite effective on grasses, where raspberry is a problem it is very effective silviculturally, it's effective on birch and aspen, but tends to be borderline on the maples to the point that if one manipulates the amount of active ingredient introduced to a site you can actually suppress grasses and raspberry to the benefit of maple if a manager chooses to do so.

This is a good example where selectivity of herbicides is brought to bear in developing a prescription across a variety of management objectives.

Q. Dr. McCormack, the Board during the course of the scoping session for this panel had a number of questions with respect to certain of these

chemicals.

Looking first at triclopyr. Can you tell me, is it in the process of being registered in Canada for use in forestry at the present time?

A. Triclopyr I added in because it's an interesting herbicide. It's one that would be a useful tool in the area of the undertaking, it is one that we have had registered for aerial application for forestry use in the United States some eight or nine years now.

It has a spectrum of activity that's somewhat different from the others here. It does not control grasses, therefore, its use enables a manager to maintain some grassy cover on the ground while it is still effective enough on raspberries, quite effective where soft maple is a problem and adequately effective on birch and aspen.

Triclopyr is marketed as the Garlon products in the United States. One of the triclopyr formulations is scheduled -- being pursued for registration in Canada. The product name will be Release Silvicultural Herbicide.

Q. And what about Garlon? What is Garlon?

A. Garlon is the same thing. Our product known as Garlon is exactly the same formulation

as that which will apparently soon become registered in Canada as Release Silvicultural Herbicide, a product of Dow Chemical Company.

It is my understanding that they expect registration for ground application some time during the current calendar year and are hopeful of having an aerial registration by calendar 1991.

Q. Mention has also been made, Dr. McCormack, in the Panel 7 statement of the evidence of a herbicide known as crenite. Are you familiar with it?

A. I am.

Q. Is it currently available for use in forestry in Canada?

A. The manufacturer Dupont has backed off and are currently inactive in pursuing the use of crenite or crenite. The active ingredient is phosamminammonium. It is an interesting herbicide, but they do not see an adequate market, especially beyond the forestry uses, to justify their efforts for registration. This is unfortunate for forestry, but those are the economic facts of the industry which manufactures the product.

Q. Still looking at this figure; that is Figure 1 on page 120 of the statement of evidence, I

direct your attention to the description of the spectra of control for glyphosate and I would ask you to compare that to 2,4-D and my question is this: Given the spectra of control reflected by this figure for glyphosate, what is your view as to the continued need in the future for the use of 2,4-D by timber managers?

A. I think 2,4-D will not be used as frequently as glyphosate. It's a very important, viable, useful tool in the toolbag of the timber manager for several reasons.

It provides some flexibility, it enables a manager to do some things that cannot be done for the other materials. The obvious example from this figure is that on a site where you wanted to maintain some grassy covering, but wanted at the same time to control, for example, an aspen overstorey, it provides a relatively low cost alternative for the timber manager to carry out such a practice.

Q. In exactly that instance, for example, would the use of glyphosate be appropriate?

A. No, because it would remove the grassy cover that would present and actually might open up the site more than the manager desired to do.

Another advantage in certain situations, recognizing that there is this wide variety of

management situations with 2,4-D, is if there is a relatively subtle herbicide. Sometimes it takes a practiced eye a year after treatment to even tell if an area has been treated, yet in the long run some management objectives can be accomplished.

2,4-D -- I was going to make a comment on tank mixes, I guess I won't.

Q. I'm sorry, on tank mixes?

A. On tank mixes.

Q. Well, could I come back to the technological aspects of it in a moment, but just dealing at this time with the basic properties of the two chemicals and the role for 2,4-D compared to glyphosate, could I ask you to go to the interrogatory responses provided by the OFIA/OLMA and perhaps, Dr. McCormack, I will provide you with question No. 3.

MS. CRONK: This, Madam Chair, is from Exhibit 1136, question No. 3 from the Ontario Ministry of Natural Resources.

Q. Dr. McCormack, if it would make it easier I --

DR. McCORMACK: A. If you have it, yes. Just set it there. Okay. This is question No. 3 from Ontario Ministry of Natural Resources.

Q. Yes. Who authored that response?

A. I did.

Q. And could you outline for the Board, please, just in general terms the nature of the inquiry and the nature of the evidence provided by way of response?

A. Well, the inquiry relates to comparing hexazinone and glyphosate with 2,4-D and asking for -- or at least addressing the comparable or better results and then is asking:

"Please advise whether given the right site conditions 2,4-D is adequate."

And the response indicates there are conditions where 2,4-D is not only adequate but preferred. Some examples are described here with reference to Figure 1 on page 120 and relates to actually one example that I just gave where it would be desirable to maintain a cover of grassy vegetation in the interest of protecting the site or where subtle suppression might be desirable.

In those cases, 2,4-D could be the best alternative, and then there is a specific case where treatment with 2,4-D would be adequate where the predominant competing brush is composed of birch, aspen and/or pin cherry, and in particular alder flats are an example where 2,4-D would be adequate.

Q. Thank you, Dr. McCormack. Dr. McCormack, looking at it from for the moment from a silvicultural point of view, if it were proposed to the Board that in the future timber managers in the area of the undertaking in Ontario should be restricted in their use of herbicides, whether for site preparation or tending purposes, to the use of 2,4-D, would you regard that as silviculturally appropriate or inappropriate?

A. From a silvicultural standpoint it would be inappropriate for timber managers to lose the use of the herbicide 2,4-D.

Q. And why is that?

A. Because of some of these advantages that I have just outlined in terms of the subtlety, the capability of maintaining partial ground cover, of having that additional lower cost option, it could be employed in a slightly different season of application than some of other herbicides available, it has been proven to be effective, it is a well understood herbicide, it has been well proven over the years, it has been in use in forestry since 1947.

Here is where I have a little difficulty because I know the subject of tank mixes is not really one to be discussed too much in the province right now,

but if the technology continues to develop or as we are able to deal with some treatments in the United States, 2,4-D is a very useful component of a tank mix that enables us to reduce the total amount of chemical which is applied in a given site.

So, for example, a manager can utilize 2,4-D as a component of a treatment thereby reducing the total amount of chemical, and at the same time reducing the cost of the tending treatment. And I would like to think some day that timber managers across the forest resource that you have in the area of the undertaking would have that capability because they would be able to practice better silviculture in a sound way at a lower cost.

Q. If I had asked you, Dr. McCormack, whether, from a vegetation management perspective, a restriction in the future on timber managers to the use of glyphosate only as a herbicide for aerial or ground application was appropriate or inappropriate, would your answer be any different than you have given me from the perspective of silviculture per se?

That questions was long, would you like me to restate it?

A. I think it makes reference to a restriction whereby timber managers would only have one

herbicide, in this case glyphosate, for use in their tending treatments that involved herbicides and I think that would be just as unfortunate.

If I may again go back to medical type examples, it would be like taking a physician and saying the only thing you can prescribe is an aspirin. Technology in our society today has gone well beyond that and a timber manager needs this flexibility because if it is glyphosate only and a manager wants to maintain some partial ground cover on a a site, that manager has lost part of the capability by only having glyphosate.

Q. My colleague here suggests that I may have misstated myself in the questions that I put. Let me just be clear about the discussion we have just had, Dr. McCormack.

In the evidence that you have just given in reply to my last two questions, did you understand that I was putting to you the proposition that in the future timber managers should be restricted to the herbicide glyphosate and not have 2,4-D available? Did you understand that?

A. I think I addressed it in a way -- I think my wording was the timber manager would only have glyphosate. I guess if there is a difference there,

then I did misunderstand the question.

Q. No, I think it was a question of the way I put it. You understood that I was suggesting as the proposition that glyphosate would be used in the future and 2,4-D would not be used?

So you are answering yes for the reporter? You are nodding your head yes?

A. May I restate this?

Q. Yes, thank you. I am sorry.

A. The timber manager would have only glyphosate and not have 2,4-D.

Q. Thank you.

A. If that is the case, then my answer stands that this would be an unfortunate restriction on the timber manager and not allow timber managers to practice what is in the best interest of the forest ecosystem.

Q. Thank you, Dr. McCormack. I think we were on the same wave length, but I didn't write my question down so I couldn't be sure.

A. I'm sorry, I may have misunderstood it.

Q. Not at all. Still dealing with this issue of the inherent properties of the various herbicides, you have dealt with the spectra of control

of these herbicides. What are the principal components of a herbicide prescription from your perspective?

What's involved in that aspect of the use of herbicides?

A. There are a variety of components and I am -- have long been a strong advocate for detailed prescription development in terms of delivering a spray mixture.

For the benefit of the Board I have tried to illustrate what are the three very basic components of a herbicide prescription, and before I get to Figure 2 on page 122 in an effort to clarify what that figure represents, I would like to show you a relatively simple cube to represent three dimensions, each dimension being one of the variables in a herbicide prescription.

These would be the total volume of the spray mixture ranging from low to high, they would be the prescribed amount; the next one would be active ingredient, in effect, the herbicide product as the active ingredient component ranging from low to high; and, thirdly, as we consider the total spray volume, including the active ingredient or product, the way this volume is delivered is according to droplet size, ranging from small size spray droplets up to large size

spray droplets.

Those three dimensions characterize the actual prescription once the herbicide product has been selected, of course, and this could be arranged. I would add that, for example, what I have included for discussion here are numbers which are appropriate to a characteristic of the use of herbicide Vision, the active ingredient glyphosate as it is used in the area of the undertaking.

It's important to consider these three dimensions because when we talk about herbicide treatments there is a tendency to say this area was treated with Vision or this area was treated with 2,4-D. And to totally understand and address the question, again the efficacy of that treatment or exactly what took place, one must, from a technical standpoint, go further than that.

It is not just this area was sprayed with 2,4-D, this area was sprayed with 2,4-D in the amount of so much active ingredient or product mix, in a total spray volume of so much and sprayed with a particle size spectrum that's defined by the volume and diameter of the spray particles, because that will make a difference in how this active ingredient was applied and will have a bearing on the relative efficacy.

So to elaborate on that just a little, one cannot just say this is a 2,4-D treatment to be compared with this 2,4-D treatment, we must be specific by defining these three that I have just mentioned.

Q. Now, generally, Dr. McCormack, I know you have indicated that you wish to talk about this overhead as a preface to Figure 2, but how generally are these factors used by managers in making prescription decisions concerning the use of herbicides?

A. The active ingredient is very definite once the herbicide is selected. We must assume here that a manager has selected the treatment, it will be 2,4-D or it will be Vision, and at that point the decision right here on active ingredient would probably be the next decision: How much product, which is a direct reflection of how much active ingredient do I the manager need to apply per hectare of treated area to accomplish my tending objective. That is very definitely a next step that is an important step.

Then depending upon what the needs are, there will be some consideration given to how much total spray volume will be required to adequately deliver the amount of active ingredient which has been

determined as an effective amount of active ingredient.

Then in considering these two items, the droplet size spectrum which is needed to adequately deliver this total spray volume is considered, not probably in as much as detail as the first two, and this will be dependent on the configuration and make-up of the delivery system in carrying out the treatment, but all three are considered and need to be understood to understand the prescription and understand what can be expected in the way of efficacy.

Q. We come then, Dr. McCormack, to the figure, Figure 2 that appears at page 122 of the statement of evidence on behalf of the Industry and yourself, and could you explain to the Board, please, what this figure is intended to illustrate?

A. Yes. I would like to take that simple box that was just up on the screen and expand that a bit to the figure that is illustrated on page 122, Figure 2 of the statement of evidence.

In effect what I have here is that same box with dimensions on it. It's an attempt to show it in three dimension looking into a back corner. Now, the stair step is in there not intended to confuse, but to show that there is a section of the volume represented in that box that would be not be an

propriate area to establish a point of a herbicide prescription.

But if one looks at the back corners and, if I may, to assist the Board, try to illustrate this, that what I have is a three-dimensional labelled box that is an extension from my last figure and what I have done is I have opened this up so that you are looking into the back corner.

So that here we have a running graduated scale of total spray volume, across this scale we have the amount of product or active ingredient which would be part of the prescription and then once a point is established on this two-dimensional grid, then somewhere on the vertical dimension we arrive at an indication of the spray particle size.

So the manager within these dimensions can can establish a point somewhere within this three-dimensional structure that I have represented here in the figure.

So that, for example, along our total spray volume here, in practice within the area of the undertaking it could range from about 15 litres to 75 litres per hectare total spray volume. As far as the product itself goes, and this complies with the dimensions of product component for the herbicide

Vision, anywhere from three litres to six litres of product per hectare and for the most part it could be expected that the volume mean diameter or spray particle size, which is expressed in microns or micrometres, would range from about 300 to 900 microns.

The manager would establish a point in consultation with the applicator, arrive at a droplet size so that within this three-dimensional structure is established a point which characterizes the herbicide application.

Now, this stair step is cut out of here because it's really not within current technology to take a volume between 60 and 75 litres per hectare and apply it with such particle sizes as small as 300 micron. Similarly, this front corner is shown as a dashed line because when you get to low volumes it would not be practical to apply low volumes of 15 to 30 litres per hectare with droplets sizes approaching the 900 micron level.

So that a manager then, by reaching the point that is determined to be the effected prescription, takes that point within this three-dimensional structure and then we could insert this into other dimension.

For example, if the back wall of the room

is year one following harvest and that wall there is year 10, the manager determines somewhere going in this direction when this point will actually be carried out in practice and applied to the site, perhaps as I stand here in year three, and we could go even further and say, if the ceiling is morning and the floor is evening when is it applied during the day.

So it's kind of three dimensions within three dimensions that begin to totally characterize a given herbicide application and at the same time is the characterization of the prescription.

Q. You said, Dr. McCormack, that this figure and these concepts, the concepts being as you have outlined them, being the total volume, the active ingredient, the droplet size, you said that this figure contains glyphosate?

A. This is appropriate to the herbicide Vision, active ingredient glyphosate as it would be used aerially. This is aerial application--

Q. Well, that was my next question.

A. --in the area of the undertaking.

Q. What would this matrix look like if it were to have been done so as to reflect ground application considerations, just in general terms?

You don't have to draw another one, but

just explain how it would be different, if at all.

A. It would require much larger volumes which would mean extending this scale very definitely up into the high end where it would approach 375 to 600 litres per hectare, which is way beyond, but in order to accomplish that same level of coverage in a ground application, this would have to go certainly something approaching 400 litres per hectare.

And in terms of practice to get an acceptable level of control, it is likely that a manager would not want to consider this lower end of rate of active ingredient because it would require that additional herbicide and volume of coverage in order to accomplish a desirable level of silvicultural effectiveness.

Q. Can you then, Dr. McCormack, illustrate for the the Board through the photographs and the slides that you refer to in the statement of the evidence some of the factors related to herbicide use that you have been describing in your evidence?

A. Yes, I think that would help a lot at this point, to show some pictorial examples of what we are talking about beyond what I think are some nice examples from the case studies which have been presented and things like the sections of the trees

which have been shown to the Board.

MS. CRONK: Madam Chair, for your assistance and that of Mr. Martel, the slides and photographs to which Dr. McCormack is going to be referring have been provided and marked as Exhibit 1135.

DR. McCORMACK: What I have here is a series of slides and I am going directly to the set of numbers without letters starting with slide No. 1, which is an aerial view in the Township 34, Maine and I have this to help illustrate where some of our information and results come from, to show for the Board how we go about developing these herbicides, evaluating effectiveness and developing the guidelines which actually are used in management and this is exactly the type of procedure that we used in developing, in particular, the herbicide at hand, Vision, and I will show some examples of that as I go on.

This is a typical layout of a harvested area. In this case, we have established additional roads to define the blocks so that we can put up flags, mark and randomly assign the treatments and they are applied under operational conditions once we go through the originally screening steps, and you can readily see

here, for example, a treatment that is certainly more effective in suppressing vegetation than the next one to the left.

MS. CRONK: Q. Dr. McCormack, as you move through these please, just to remind you for the assistance of all of us, there is a reporter here and when you say here, if you could just describe it verbally to the extent that you can, it will help us later on.

DR. McCORMACK: A. I'm sorry, I forget that.

Q. Thank you.

A. It is a little difficult with this slide because this is a general aerial view showing probably a dozen different treatment plots and all that is shown here are different levels of suppression from a variety of randomly assigned treatments.

Q. Thank you. And what photograph number is this, please?

A. This is No. 1. Moving on to No. 2, which is a photograph taken on the ground of that same area that was shown in No. 1, to show one of the test treatments, in this case it was a glyphosate plus a metsulfuron treatment.

That's not particularly important at this

point, but I show this as an example of what at least we would consider to be on the edge of adequately silviculturally effective. You still see green foliage there, but you can also see suppression in these trees in the foreground which are defoliated woody brush; that is competition.

In the background one can see some broad leafed, woody brush which has not been suppressed by the treatment. It illustrates selectivity and at the same time scattered through the picture, and especially over here on the left, is a coniferous tree which is coming through nicely following the treatment. That is No. 2.

Going on to No. 3, goes back to treatments carried out some 10 plus years ago which was actually the first aerial application of hexazinone ever conducted with the product. It was a spruce plantation of Georgia Pacific Corporation in eastern Maine. This is a picture taken one year after treatment in the untreated, one of the randomly assigned untreated blocks showing raspberry and beech sprouting. That is a spruce plantation inundated with undesirables.

Now, if I can take you to No. 4 which is a picture taken the same date in a hexaxinone treated

block, these treatments were applied by helicopter. We see the same foliage conditions or plant structure present, but we see a distinct difference which is the effect of the hexazinone in suppressing the beech and the raspberry through the benefit of the planted spruce which are there but are not readily visible in this picture.

So what you have here in No. 3 and this one, No. 4, is a with and without comparison illustrating the effects of hexaxinone applied by helicopter to suppress heavy competing vegetation in a black spruce plantation.

Q. Dr. McCormack, just stopping at that photograph, if I might, will the vegetation shown in that picture as having been effected by the hexazinone re-emerge on site over time?

A. Some of it will, especially the beech, but our intent here was to achieve something in the order of a three-year period of silvicultural effectiveness to allow the planting spruce trees to become established and development of growth so that they would be in a competitive position, but it's certainly expected and in fact it happened that there would be regrowth.

Q. Thank you.

A. There is a very heavy root system of beech here and they were not totally controlled.

Going on to No. 5, I am still in the same series of treatments to illustrate selectivity. No. 5 is the same study site as the preceding two pictures showing the suppression of beech and raspberry in the foreground, but across some of the higher ground in the background you can see woody brush that is still pretty well in full leaf.

The woody brush there is principally soft maple, in this case red maple which is not susceptible to hexazinone. So here in the foreground you see hexazinone exerting its effectiveness on species which are susceptible to hexazinone, in the background, maple which is relatively tolerant to hexazinone and this in a way is a pictorial illustration that shows what was illustrated in Figure No. 1 of the spectrum of activity of hexaxinone.

Taking the same series one step further to slide No. 6 and the same series treatments, though in this case we have planted red pine, this illustrates and you can see in the centre, in front of the individual standing in the centre of the picture one of the planted red pines. There are others visible there in the photograph scattered through with the spacing at

which they were planted.

Now, here there is some raspberry present which is no longer visible because it was susceptible to the hexazinone treatment. Similarly, one can still see the unfoliated frames of trembling aspen brush which was present on the site, aspen being susceptible to the hexazinone.

However, scattered about through the photograph are clumps of green which, again, are soft maple. So this takes the spectrum of activity a little bit further in this slide showing efficacy on raspberry, some efficacy on grassy cover, efficacy on trembling aspen but not effective on the soft maple.

This is a photograph taken from a series of tests in the development of triclopyr in northern New Brunswick showing what I refer to as a subtle suppression of woody brush. It was a Fraser Company spruce plantation that had become overgrown with brush to the point that you can't see the spruce trees in the photograph.

You can see that there has been a fair amount of suppression in the skeletal frames visible in the picture; however, since this was a relatively low rate and in the early stages of developing, triclopyr is the example that we learned that it was not

effective at this stage of the game on hazel. This is common hazel, hazel nut.

Next is a large clump of heavy green that's in the centre of the photograph and this also illustrates the type of information that we develop in the early stages to quantify the spectra of control so that we can learn what species are susceptible and which are not and what rates of active ingredient are required where we do achieve suppression.

Q. Which photograph number is this one, Dr. McCormack?

A. This one is No. 7.

Q. Thank you.

A. In Nos. 8 and 9 I want to illustrate two types of control that are possible in terms of physically placed in sequence of regenerating a forest. In this case, with the current technology that exists in the northern United States and Canada, would necessarily be a ground application; however, I included this because it is of interest when one considers any possibilities of partial cutting in spruce, fir or similar forests.

This was a partial cut of spruce fir in northcentral Maine in which I was studying the establishment and the development of natural

regeneration. And following this partial cut, as you can see on the left side, there is an individual standing in the centre of this photograph with a range pole.

To your right of that individual is a treated portion of the plot, to your left an untreated portion and you see here with the partial cut of this stand the development of woody brush that is interfering with established natural regeneration as compared to a ground application of herbicides suppressing that woody brush and is, in fact, allowing the natural regeneration to become established and grow.

In contrast to that I show a photograph next, which is No. 9, of a relatively straightforward overstorey suppression in control. This is a photograph taken in the northcentral district of Ontario when I was there in 1982. It shows very nicely an appropriate use of 2,4-D as an aerial application of aspen overstorey, which are the taller skeletal frames, over softwood regeneration.

I think this was about two years after treatment, and one could readily see the aggressive development of the softwood stand underneath the overstorey which has been suppressed. This is No. 9.

Nos. 10 and 11, 10 coming next, shows a planted white spruce seedling. This is a study I conducted in the late 1960s and up through the early 70s in planting white spruce on grassy and other ground cover weeds. There were bareroot seedlings.

Two pictures. This one taken two years after treatment shows an average planted white spruce seedling, though I have to qualify this that around the base of tree I manually removed the weeds just prior to taking the photograph in order to show the tree and its condition. So there are no weeds around that tree because I removed them manually for the purpose of photographing what, through measurments, was determined to be an average white spruce tree two years after planting.

In contrast to this, No. 11 is an average treated, herbicide treated tree, same planting, same site, same bundle of planting stock, also two years after treatment. So one should compare the condition of this untreated tree with the treated tree taken under exactly the same timing and conditions with the exception this had the benefit of herbicide weed control. That is, as I say, a white spruce in the same planting sequence.

Q. When you say the same planting

sequence, Dr. McCormack, does that mean, that the trees were planted at the same time?

A. These were trees planted from the same bundle of trees produced in the Vermont State nursery, planted all within the same hour. I planted these trees myself for the purpose of the study.

So there is a very direct comparison there between photographs 10 and 11. This is showing the treated tree.

Q. How would you compare for the record, Dr. McCormack, the size of the trees in those two photographs?

A. Well, the individual standing in the photograph was wearing a boot that was -- as I recall he wore size 10, but it is certainly in that kind of a category, so you can see his two feet. It is one of my technicians wearing about a size 10 and you can see that the tree extends well up his calf, but not as far as the knee.

Q. I am sorry, and how would you compare that to the tree evident in the photograph of the untreated area?

A. The one in the untreated area we don't have the benefit of the boots, but it's -- I would judge it to be somewhere in the neighbourhood of

half as tall, but the most significant thing to observe here is the caliper of the stem, the lack of foliage and the inferior condition. By inferior I mean shorter needles, fewer needles and much porousness in the colouration of the needles of this trees as compared to the treated one. This is smaller and distinctly less robust.

Going on to No. 12. No. 12 is a view with a road running down the centre of the photograph. This was an area treated aerially with the herbicide 2,4,5-T on the land of Robin's Lumber Company in Waldorf County, Maine. The area to the right of the road was treated, the road was used as a boundary for the spray operation because there were some sporting camps and a lake several hundred yards to the left of this photograph, so they treated the operational stand to the right. This photograph was taken 22 years after treatment.

So this is included to illustrate that where we do have records and can observe long-term results, and no measurements were taken here, I think it can be observed that we have a commercial stand in place on the right and we have small diameter, unmerchantable stems of an inferior species mix on the untreated portion on the left.

Going on to No. 13. No. 13 is the first slide in a series of three. This is a strip clearcut in northcentral Maine, the commercial species are spruces and fir. It was a mechanically harvested strip cut with the intention of securing natural regeneration initially from the adjacent stand and it was the site of one of our very first, in 1978, aerial applications of triclopyr. In fact, it was one of the first aerial applications.

Because I was restricted in the equipment available, I had to pile it via a single swath down the right side of the strip. The swath width was inadequate to cover the whole strip so I elected to go with one swath only, leaving the unsprayed portion as vegetation to develop. You can see a fairly well defined strip.

This photograph was taken one year after treatment. And for your reference, as you look at the next two photographs, I direct your attention to a single white birch tree standing along the edge of the residual stand on the right side of the strip because some changes do take place here. That tree stands throughout the picture sequence.

Going on then looking down the same strip, I have an August photograph taken four years

after treatment and here you see the same birch tree to the rear, we have the swath to the right and one can see I have placed a range pole; that is, a range pole is a metric range pole so that a red stripe plus a white stripe totals one litre in length. It is along the edge of the original spray swath.

So four years after treatment an August photograph illustrates the development of the competing vegetation along the edge, and as you look carefully in this photograph you see merchantable species of conifer developing in the release portion. This has quite a bit of vegetative cover, it is considered silviculturally a success and is the type of thing that would be considered silviculturally effective, in this case following a triclopyr treatment. I am showing this four years after treatment.

Now, the third picture takes us through winter, still though only four growing seasons after treatment, the same strip but I have to point out, here is our birch tree still here. During the winter harvest the adjacent residual stand was removed, but we still have the strip.

The photograph was taken early enough in the season that we did not have new leaf out. This line that you see down through here is the edge of the

original spray stand.

Q. You are pointing to the left side of the photograph in the background and the foreground?

A. The right side of the photograph shows the original spray swath now filled with green because of the conifers which are evident. To the left, between the green and a residual stand which is still in place on the left, is a narrow strip that shows the area that was not sprayed.

And I would point out that in the study of strip cuts and regeneration of strip cuts it is usually the case that the maximum amount of regeneration develops in this transition area between the strip and the residual stand. So if we don't consider the time period in the development of the competing vegetation, we would expect to see most of the regeneration in this area where now there is the least.

So what you have in this picture is a graphic portrayal of the gain of improved stocking and a manageable situation of crop trees resulting from one application of triclopyr which occurred in a timely manner.

Q. And that was photograph number...?

A. This is photograph No. 15.

So this shows a sequence that illustrates the question which comes up: Is stocking actually improved, and this shows a very-well defined edge of a spray swath illustrating that yes, it was.

This is a photograph of one of my original screening plots eight years after treatment in one of the original study plots applying glyphosate. When you see that this photograph was taken in 1983 and it is eight years after treatment, you can readily see that it was in the early stages of developing glyphosate.

My procedure in screening plots was to tiptoe through with a minimum disturbance of the target to the centre of a circle that was a four-metre radius, put a stepladder in place, climb to the top of the ladder and simulate an aerial application from above on the undisturbed undesirable vegetation and then tiptoe back out in the same footsteps and then come back a year later to start my evaluation. I would place a stake in the plot centre adequately labelled with tags and so forth, and these treatments were assigned at random through a series of such circular plots.

This was, as I say, in the early stages of developing glyphosate. This is eight years after treatment. The individual in the picture is standing

in the centre of the plot with the same range pole showing a spruce tree in the centre with excellent growth and you can see a patch of potential crop trees there.

Those crop trees are actually the vegetation within my four-metre radius circular plot showing that's where the glyphosate was treated. The surrounding area around the plot was untreated and you see there an eight-year benefit from what would now be, in terms of volume and rate of active ingredient, an operational treatment for Vision or Roundup, glyphosate the active ingredient.

Q. That was photograph No. 16?

A. This is photograph No. 16. Going on to No. 17, which is the first in a series, it is a little hazy because it was so dark, it was difficult to get the photograph.

This series is a series which I took over a period of time. This one in September '84 on the operations of J.D. Irving Limited, their Black Brook operations in northern New Brunswick.

The reason I brought these in is some of the more -- most intensive silviculture being practised in the world today in the way of spruce plantations and properly prescribed timely release has been carried out

for many years by the Irving operations, mainly in the Province of New Brunswick.

This first photograph is for the purpose of comparison. It was one of the Irving's earliest spruce plantations planted and left to grow. It is one of the few examples on their ownership where no release or site preparation was done. They went in after harvest and planted.

If one looks carefully in this photograph you see some trees that are roughly anything from shoulder to head high with orange ribbons on them. Those are the spruce trees that were part of the original plantation and they're barely hanging in there. They are not doing well and it is reasonable to expect that they will slowly drop out of the stand. So I offered this as a basis for comparison of what happens over time without release.

In comparison, this is a portion of a more recent plantation, this one being white spruce, where a timely release was applied somewhere in the third to fourth year after planting which followed site preparation.

This is a much younger spruce plantation and all I say is look at the growth. It's caliper, the leader growth, the vegetation of crop trees is

outstanding, but you also see small vegetation present and scattered throughout the plantation. So you can make a comparison there.

Along a similar line is a black spruce plantation showing the scattered vegetation through the plantation, a photograph I took in '76, where again black spruce planted following site preparation and with a timely release to secure the establishment of the plantation, and one can can readily observe here good stocking and good growth and development of the black spruce crop trees.

Q. How many years after planning was that photograph taken, Dr. McCormack?

A. I took this photograph in October '76. The trees were planted, as indicated by the sign in the photograph, in planting season of 1970.

Q. And that's No. 19; is that correct?

A. This is photograph No. 19.

Q. I am going to invite you just to finish this particular series, Dr. McCormack, and then I expect that the Board will wish to rise for the day.

A. If I can do two more--

Q. Yes.

A. --I would get to a convenient place to recess.

Q. Thank you.

A. Two more photographs in northern New Brunswick, the Irving operation.

This one, a photograph taken in 1976 for comparison with the next photograph. This one is No. 20, taken to compare with No. 21.

This is also a spruce plantation in the first year after planting. A general view, just consider the position of the road which runs down the right side of this photograph and then let's go back eight years later to the same point and taking a picture down the same road, again showing the benefit of timely release in establishing this spruce plantation on the Irving operation. So this is eight years after the preceding photograph.

Q. Dr. McCormack, with respect to photograph No. 20, first, was that a plantation?

A. It is a plantation.

Q. And how many years after planting was that photograph taken; that is, photograph 20?

A. That was -- it was the first or second I think -- wait a second. End of the first year after planting.

Q. And how many years after planting then was this latter photograph, photograph 21?

A. This would be nine years. So we are here in one year after planting, coming back eight years later would be nine years after planting, but the sequence of photographs is eight years apart.

Q. And can you, for the assistance of the Board and the record when we come back to this some time from now, describe in words how, based on your views, you would compare the trees in these two photographs?

A. Well, this illustrates rapid growth rate, good thorough establishment. When one talks about stocking in these plantations, it is kind of a silvicultural rule of thumb that there is no future in planting dead trees.

In the Irving operations, they strive to achieve survivals on the order of 98 per cent and I think that's well illustrated here, that the survival is probably as high as anyone could ever hope to achieve.

So we see here good growth, good vigorous foliage development and excellent stocking as a result of their intensive tending procedure.

Q. And what chemical was used for the release treatments with respect to photograph 21?

A. The release treatments here would

have been phenoxy treatments, meaning a tank mixture of 2,4-D and 2,4,5-T at relatively low rates.

The practice in the Irving operation is to try and keep the rates as low as possible but get the results needed through proper timing of those applications.

Q. Was photograph No. 20 then taken before or after the release?

A. It would have been prior to the release, one year after planting and the release treatment would have taken place one to two years, I am not sure which, following photograph 20.

Q. Thank you.

MS. CRONK: Madam Chair, we are clearly not finished with the photographs, but would this be a convenient time for the Board to break?

MADAM CHAIR: Yes. How many more photographs do we have, Dr. McCormack?

DR. McCORMACK: We have just finished 21 and the total number is 43, so we are looking at -- we are about half way through.

MADAM CHAIR: All right. Why don't we adjourn now for the day and we will be back on May the 28th.

MS. CRONK: Monday, May the 28th.

MADAM CHAIR: We will start at ten o'clock on Monday morning.

MS. CRONK: At ten o'clock?

MADAM CHAIR: May 28th, that's right. 10:00 a.m. here.

MS. CRONK: For the assistance of the Board and my friends, I expect to finish the evidence-in-chief certainly that morning. Taking into account ten o'clock now, perhaps around the noon hour. It would be about there.

So ten o'clock on the 28th. Thank you very much, Madam Chair.

MADAM CHAIR: And, Mr. Castrilli, you will be cross-examining first then?

MR. CASTRILLI: Madam Chairman, I will be here to cross-examine that day. Whether I go first or not still remains to be seen.

MADAM CHAIR: All right, fine.

Mr. Freidin?

MR. FREIDIN: How long will Mr. Castrilli be?

MADAM CHAIR: Do you have any estimates of the time in cross-examination?

MR. CASTRILLI: I believe I have been telling everyone who has been asking approximately one

and a half days. If I am longer than that it wouldn't be longer than an additional half day.

MADAM CHAIR: All right. And do we have an estimate from Mr. Hanna?

MS. CRONK: The last information that I received from Mr. Hanna was that Mr. Hanna anticipated that he would be a day.

MADAM CHAIR: Mr. Freidin?

MR. FREIDIN: Half a day.

MADAM CHAIR: Okay.

Ms. Seaborn?

MS. SEABORN: Two to three hours.

MADAM CHAIR: Has somebody added all that up?

MS. CRONK: I am doing that right now, Madam Chair.

MR. FREIDIN: Four days.

MS. CRONK: Four days.

MS. SEABORN: And, Madam Chair, Ms. Kleer advised me that she thought she would be half a day to three quarters of a day.

MS. CRONK: May I suggest this in those circumstances. Ms. Devaul provided counsel with a copy of the Board's schedule at the luncheon break today and I was grateful, on behalf of our clients, to note that

the Board in that schedule had indicated that it would sit Monday through Thursday of that week.

The Board is aware that both Dr. McCormack and Dean Carrow have commitments long established, and I mean by months long established, commencing the following week. May I suggest that the Board consider sitting on the Friday of that week as well or we will certainly not finish.

It seems that it will be possible to finish based on these estimate on the Friday if we -- I recognize, sir, that's a long week for all involved, but if the Board was prepared to consider that, I think it possible that the evidence could conclude.

I also note that in past estimates of a day or a day and a half have sometimes proven to be considerable less, although of course they have proven to be considerably more, but of late that has been the case.

MADAM CHAIR: The Board is prepared to finish Panel 7's evidence that week.

MS. CRONK: Thank.

MADAM CHAIR: All right. Thank you very much.

We will see some of you in Fort Frances next Wednesday and we will reconvene on May 28th at

10:00 a.m.

Thank you very much.

---Whereupon the hearing adjourned at 5:00 p.m., to be reconvened, Monday, May 28th, 1990 commencing at 10:00 a.m.